



General Construction Specifications

2014 Edition

Version 2.0

DOCUMENT REVISION HISTORY

Revision	Date (Y-M-D)	Description
1.01	2019-07-09	Drawing 50.60.01 and 50.60.02 revised.

GENERAL
CONSTRUCTION
SPECIFICATIONS
TABLE OF CONTENTS

DIVISION 01	General Requirements
DIVISION 02	Existing Conditions
DIVISION 03	Concrete
DIVISION 31	Earthwork
DIVISION 32	Exterior Improvements
DIVISION 33	Utilities
DIVISION 34	Transportation
DIVISION 50	Construction Specification Drawings

Section 01 14 00	Work Restrictions
Section 01 33 00	Submittal Procedures
Section 01 35 14	Traffic Control
Section 01 35 30	Health and Safety Requirements
Section 01 35 43	Environmental Procedures
Section 01 41 00	Regulatory Requirements
Section 01 42 00	References
Section 01 45 00	Quality Control
Section 01 51 05	Temporary Work
Section 01 53 40	Hauling and Haul Roads
Section 01 58 99	Temporary Construction Signing
Section 01 61 00	Common Product Requirements
Section 01 74 11	Cleaning

1. GENERAL

This Section provides common work restrictions that may affect a construction project. The contact information provided is for general reference however it does not negate the Engineer or Contractor from contacting Alberta One Call before proceeding to work. The following restrictions relate to:

- Working around existing utilities.
- Connections to existing services.
- Noise generating restrictions.

1.1 Working Around Existing Utilities

- .1 For locations of underground utilities and pipelines.

Alberta One Call
Phone: 1.800.242.3447

- .2 The Contractor shall be responsible for notifying the appropriate Town Departments and utility companies of his intention to carry out operations in the vicinity of any existing main, line, conduit or other structure or utility, treed and/or natural feature, at least one week in advance of any such operations being carried out. The Contractor shall arrange a site meeting with the Consultant and one representative of any Town Department or utility company requiring relocation or new installation during construction. The following is a list of utility agencies commonly involved in the Sylvan Lake area:

- .1 In the case of water, sanitary, and storm sewer lines:

Town of Sylvan Lake Public Works Department
Phone: 403.887.2800

- .2 In the case of overhead or underground electric power lines, street lighting and home runs:

Fortis Alberta
Phone: 403.310.WIRE (9473)
1.403.514.4000 (Calgary Office)

- .3 In the case of overhead or underground electric power transmission lines:

AltaLink Management Ltd. (Calgary Office)
Phone: 1.866.451.7817

Fortis Alberta
Phone: 403.310.WIRE (9473) or 1.403-514.4000 (Calgary Office)

- .4 In the case of underground natural gas pipelines:

ATCO Gas (Red Deer Office)

Phone: 403.357.5200

- .5 In the case of overhead or underground telecommunication lines (including fibre-optic):

Shaw Communications Inc. (Red Deer Office)

Phone: 403.346.6633

Telus Communication Inc.

Phone: 1.800.317.3363

- .6 In the case of trees and/or natural features:

Town of Sylvan Lake Public Works Department

Phone: 403.887.2800

- .3 The Contractor, at his expense, is to conduct his operations in accordance with the requirements of the utility authorities having jurisdictions.

1.2 Connections to Existing Mains

- .1 The Contractor shall make connections to existing water, sanitary and/or storm mains where specified on the Drawings.

1.3 Noise Generating Work

- .1 Carry out noise generating work in accordance with The Town of Sylvan Lake Community Standards Bylaw No. 1592/2012.
- .1 Exception to the extent permitted by the Community Standards Bylaw, no person shall use, operate or allow to be used or operated any tools, machinery or equipment so as to create Noise or Disturbance which may be heard in a residential building between the hours of 10:00 p.m. on any day to and including 7:00 a.m. of the following day.

1. GENERAL

This Section includes submissions of shop drawings, product data and samples.

1.1 Related Sections

- .1 Quality Control Section 01 45 00

1.2 Administrative

- .1 Submit to the Engineer submittals listed for review. Submit with reasonable promptness and in orderly sequence so as to not cause delay in the Work.
- .2 Work affected by the submittal shall not proceed until the Engineer's review is complete.
- .3 Review submittals prior to submission to the Engineer. Submittals not stamped, signed, dated, and identified will be returned without being examined and shall be considered rejected.
- .4 The Contractor's responsibility for errors or omissions in submission from requirements of the Contract Documents is not relieved by the Engineer's review.

1.3 Shop Drawings, Mix Designs, and Product Data

- .1 Shop Drawings
 - .1 All shop drawings shall be accurately drawn to a scale sufficiently large to show all pertinent features of the item and its method of connection to the Work.
 - .2 Unless otherwise specifically directed by the Engineer, shop drawing prints shall be made in blue or black line on white background.
 - .3 The Contractor shall submit three copies of all shop drawings.
- .2 Mix Designs
 - .1 Mix designs are required or specified in other Sections of the Specifications.
 - .2 All mix designs shall be completed by a qualified, independent materials testing agency approved by the Engineer.
 - .3 Mix designs to be submitted at least three weeks prior to commencing work.
- .3 Colours
 - .1 Unless the precise colour and pattern is specifically described in the

Contract Documents, whenever a choice of colour or pattern is available in a specified product, the Contractor shall submit accurate colour charts and pattern charts to the Engineer for his review and selection.

.4 Identification of Submittals

- .1 The Contractor shall completely identify each submittal and re-submittal by showing at least the following information:
 - .1 Name and address of the Contract and the Contractor, plus name and telephone number of the individual who may be contacted for further information.
 - .2 Project Name, Drawing Number, and Specifications Section Number to which the submittal applies.
 - .3 Identify original submittals or re-submittals.

.5 Coordination of Submittals

- .1 Prior to submittal for the Engineer's review, the Contractor shall use all means necessary to fully coordinate all material, including the following procedures:
 - .1 Determine and verify all field dimensions and conditions, materials, catalogue numbers, and similar data.
 - .2 Coordinate, as required, with all trades and with all public agencies involved.
 - .3 Secure all necessary approvals from public agencies and others and signify by stamp, or other means, that they have been secured.
 - .4 Clearly indicate all deviations from the Contract Documents.

.6 Timing of Submittals

- .1 The Contractor shall make all submittals far enough in advance of scheduled dates of installation to provide all required time for review, for securing necessary approvals, for possible revisions and re-submittal, for placing orders, and securing delivery.
- .2 In scheduling, the Contractor shall allow at least five full working days for the Engineer's review following his receipt of the submittal.
- .3 Costs of delays occasioned by tardiness of submittals will not be borne by the Owner.

.7 Approval of Submittals

- .1 Review of all submittals by the Engineer is limited to evaluating if the materials, equipment, and methods conform to the intent of the design. The Contractor shall remain fully responsible for the accuracy of all work and the quality and reliability of all materials and equipment.
- .2 Adjustments made on submittals by the Engineer are not intended to change the Contract Price. If adjustments affect the value of Work, state such in writing to the Engineer prior to proceeding with the Work.

1. GENERAL

This Section identifies the procedures to be followed when roadway traffic is to be accommodated during construction.

1.1 Related Work

- .1 Temporary Construction Signing Section 01 58 99

1.2 References

- .1 Manual of Uniform Traffic Control Devices for Canada (MUTCD), Transportation Association of Canada (Current Version).
- .2 Manual on Uniform Traffic Control Devices (MUTCD), US Federal Highway Administration, Part IV, (Current Version)
- .3 Traffic Accommodation in Work Zones (2008), Alberta Transportation (1st Edition).

1.3 Protection of Public Traffic

- .1 Comply with requirements of Acts, Regulations, and By-laws in force for regulation of traffic or use of roadways upon or over which it is necessary to carry out work or haul materials or equipment.
- .2 When working on traveled way:
 - .1 Place equipment in position to present minimum interference and hazard to traveling public.
 - .2 Keep equipment units as close together as working conditions permit and preferably on same side of traveled way.
- .3 Do not close any lanes of roadway without approval of the Engineer. Before rerouting traffic, erect suitable warning signs.
- .4 Keep traveled way graded, free of potholes, and of sufficient width for required number of lanes of traffic.
 - 1 Provide minimum 8m wide temporary roadway for traffic in two-way sections through work and on detours.

- .2 Provide minimum 5m wide temporary roadway for traffic in one-way sections through work and on detours.
- .5 As indicated or as directed by the Engineer, provide temporary graveled or paved detour road(s) to facilitate passage of traffic around restricted construction area.
 - .1 Excavation/Construction of temporary detour road in accordance with Section 31 24 13 – Roadway Embankment and Compaction.
 - .2 Place and compact granular sub-base in accordance with Section 32 11 19 – Granular Sub-Base.
 - .3 Place and compact granular base in accordance with Section 32 11 23 – Granular Base.
 - .4 Place and compact asphalt concrete pavement in accordance with Section 32 12 14 - Asphalt Prime Coat.
 - .5 Place and compact mixed-in-place asphalt paving in accordance with Section 32 12 20 – Mixed-in-Place Asphalt Paving.
 - .6 Provide and maintain road access and egress to property fronting along Work under Contract and in other areas as indicated, unless other means of road access exist that meet approval of the Engineer.

1.4 Information and Warning Devices

- .1 Provide and maintain signs, flashing warning lights, and other devices required to indicate construction activities or other temporary and unusual conditions resulting from project work which requires road user response.
- .2 Supply and erect signs, delineators, barricades, and miscellaneous warning devices as specified in Part D, Temporary Conditions Signs and Devices, of MUTCD.
- .3 Place signs and other devices in locations recommended in MUTCD.
- .4 Meet with the Engineer prior to commencement of Work to prepare list of signs and other devices required for the project. If the situation on site changes, revise the list to the approval of the Engineer.
- .5 Continually maintain traffic control devices in use by:

- .1 Checking signs daily for legibility, damage, suitability and location. Clean, repair, or replace to ensure clarity and reflectance.
- .2 Removing or covering signs which do not apply to conditions existing from day to day.

1.5 Control of Public Traffic

- .1 Provide flag persons, trained in accordance with and properly equipped, as specified in MUTCD in the following situations:
 - .1 When public traffic is required to pass working vehicles or equipment which block all or part of traveled roadway.
 - .2 When it is necessary to institute one-way traffic system through construction area or other blockage where traffic volumes are heavy, approach speeds are high, and traffic signal system is not in use.
 - .3 When workmen or equipment are employed on traveled way over brow of hills, around sharp curves, or at other locations where oncoming traffic would not otherwise have adequate warning.
 - .4 Where temporary protection is required while other traffic control devices are being erected or taken down.
 - .5 For emergency protection when other traffic control devices are not readily available.
 - .6 In situations where complete protection for workmen, working equipment, and public traffic is not provided by other traffic control devices.
 - .7 Delays to public traffic due to the Contractor's operators: maximum 5 minutes.
- .2 Where roadway, carrying two-way traffic, to be restricted to one lane, for 24 hours each day, provide portable traffic signal system. Adjust, as necessary, and regularly maintain system during period of restriction. Signal system to meet requirements of Part IV of Manual of Uniform Traffic Control Devices to Street and Highways, US FHWA.

1.6 Operational Requirements

- .1 Maintain existing conditions for traffic throughout period of Contract except, when required for construction under contract and when measures have been taken as specified herein and approved by the Engineer to protect and control traffic, existing conditions for traffic to be restricted as follows:
 - .1 Close one lane.
 - .2 Reduce speed limit.
 - .3 Close road to public traffic when detour provided along existing routes paralleling or within right of way.
- .2 Maintain existing conditions for traffic crossing right of way except when required for construction. With approval of the Engineer, existing conditions for cross traffic to be restricted as follows:
 - .1 Reduce number of crossing locations.
 - .2 Reduce speed limit.
 - .3 Delays to public traffic: maximum 5 minutes.

1.7 Parking Restrictions

- .1 Obtain and set out No Parking signs, if required, from The Town of Sylvan Lake's Public Works Department, and pay the said Department at the Current published rates.
- .2 Pay for replacement or repair of lost, damaged, or removed No Parking signs.
- .3 Obtain parking restriction authorization from The Town of Sylvan Lake's Public Works Department.
- .4 Place equipment to minimize interference and hazard to travelling public.
- .5 Do not leave materials or equipment on arterial roadways overnight. If equipment and/or material must be left on collector or local roadways overnight, permission must be obtained from the Engineer, and all equipment and material must be properly barricaded and signed.

1.8 Removal and Installation of Signs

- .1 All existing traffic signs that must be permanently or temporarily removed or relocated due to the construction shall be removed or relocated by The Town of Sylvan Lake's Public Works Department. The Contractor shall provide sufficient notice to the Public Works Department to have all necessary signs removed or relocated prior to commencement of construction.
- .2 The Contractor to maintain a record of all signs removed. Record sign type (stop sign, street name sign, etc.), location (station as per grad sheet), and date removed.
- .3 The Contractor shall be responsible for the cost of repair or replacement of any traffic signs damaged as a result of construction activities if the Contractor has not requested the removal or relocation of such signs from the construction zone.
- .4 Critical signs, such as Stop and Yield signs, necessary for the protection of traffic, shall be temporarily erected and maintained by the Contractor during the period of construction. Permanent signs required in accordance with the Construction Drawings shall be installed by the Town of Sylvan Lake's Public Works Department.

1. GENERAL

This Section includes and clarifies the safety requirements applicable to the Work.

1.1 Construction Safety

- .1 The Contractor shall be solely responsible for construction safety on the Work site and shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Work.
- .2 The Contractor shall ensure compliance, on its part, and on the part of all its Subcontractors, with safety measures of the National Building Code, Alberta Occupational Health and Safety Act, Worker's Compensation Board, and the Municipal Authority, provided that in case of conflict or discrepancy, the more stringent requirements shall apply.
- .3 The Contractor shall appoint a representative to be responsible for communication with the Owner, Engineer, Workers, and Alberta Occupational Health and Safety, with respect to health and safety issues. Such representative shall be familiar with the health and safety rules, regulations, and procedures applicable to the Work, and shall ensure that all workers comply with such rules, regulations, and procedures.
- .4 The Contractor shall ensure the health and safety of all persons on the Work site, including workers in his employ, Subcontractors, Engineer and Owner representatives, and members of the general public.
- .5 When working in or immediately adjacent to areas where public traffic access is permitted (roadways, lanes, parking lots, etc.), all workers shall wear a traffic safety vest acceptable under the Occupational Health and Safety regulations.
- .6 The consumption of restricted drugs or alcohol will not be permitted at the Work site. Anyone in possession of or under the influence of restricted drugs or alcohol shall be dismissed from the Work site.

1.2 Safety Briefing

- .1 The Contractor shall make arrangements to have the Alberta Occupational Health and Safety representative attend the preconstruction meeting to brief the Contractor on site safety requirements before any work is commenced.
- .2 Prior to commencing the Work, the Contractor shall provide the Engineer with a copy of their health, safety and security policies, rules, and procedures, as well as a list of employees certified in First Aid.

1.3 Hazardous Work

- .1 Hazardous work situations include, but are not limited to
 - .1 Use of flame producing equipment.

- .2 Use of power actuated tools.
- .3 Work inside any enclosure or area that may contain toxic vapour, dust, or be oxygen deficient.
- .4 Work in an excavation.
- .5 Work on or near live electrical lines or equipment.
- .6 Use of or exposure to hazardous chemicals.
- .2 The Contractor shall comply with the requirements of the Transportation of Hazardous Goods Act and the Workplace Hazardous Materials Information System (WHMIS) regarding the transportation, use, handling, storage, and disposal of hazardous materials, and regarding labelling and provision of safety material data sheets acceptable to Labour Canada and Health and Welfare Canada.
- .3 Hazardous work shall not commence until all workers have been informed of the hazards involved in the Work they are about to perform, are adequately trained in the performance of the hazardous work, are provided with appropriate personal protection equipment, and trained in the use of said equipment.
- .4 The Contractor shall train workers and have available all equipment necessary to perform a rescue from a hazardous work area.

1.4 Accidents and First Aid

- .1 Maintain on site, adequate equipment and medical facilities, as required by Alberta Occupational Health and Safety, to supply first aid service to anyone injured in connection with the Work.
- .2 Post local emergency numbers near telephones.
- .3 Report any accidents, injuries, or emergencies to Alberta Occupational Health and Safety and Workers' Compensation Board.

1.5 Security

- .1 Provide all necessary lighting, fencing, hoarding, signage, and security personnel to adequately protect the Work and the public.

1.6 Explosives

- .1 Handle, store, and transport explosives in accordance with local by-laws, the provisions of the Explosives Act (Canada), and the Explosive Safety Regulations contained in Alberta Regulations made under the Occupational Health and Safety Act.
- .2 Explosives not to be used or stored on-site without the Engineer's approval.

1. GENERAL

This Section includes general environmental protection requirements to these Specifications. Some specification sections may contain additional environmental protection requirements.

1.1 Related Sections

- | | | |
|----|-----------------------|------------------|
| .1 | Clearing and Grubbing | Section 31 11 00 |
|----|-----------------------|------------------|

1.2 Protection

- | | | |
|----|--|--|
| .1 | Fires and Burning | |
| .1 | Fires and burning of rubbish on the site, permitted only when approved by the Engineer. | |
| .2 | Where fires or burning are permitted, prevent staining or smoke damage to structures, materials, or vegetation which is to be preserved. Restore, clean and return to new condition stained or damaged work. | |
| .3 | Provide supervision, attendance and fire protection measures as directed. | |
| .4 | All efforts must be made to preserve all topsoil/root material to be placed back on the site for a viable seed source. | |
| .5 | Topsoil from these areas must be laid down within one season of original excavation. | |
| .6 | All efforts must be made to stay away from any treed area to be preserved. A minimum of 10 meters setback measured from the closest tree trunk. | |
| .7 | Any preserved areas must be fenced and absolutely no equipment may be operated or parked within the fenced area. | |
| .2 | Disposal of Wastes | |
| .1 | Do not bury rubbish and waste materials on site unless approved by the Engineer. | |
| .2 | Do not dispose of waste or volatile materials, such as mineral spirits, oil or paint thinner into waterways, storm, or sanitary sewers. | |

.3 Drainage

- .1 Provide temporary drainage and pumping as necessary to keep excavations and site free from water.
- .2 Do not pump water containing suspended materials into waterways, sewer, or drainage systems.
- .3 Control disposal or run-off of water containing suspended materials or other harmful substances in accordance with local authority requirements.

.4 Site Clearing and Plant Protection

- .1 Protect trees and plants on site and adjacent properties where indicated.
- .2 Restrict tree removal to areas indicated or designated by the Engineer.
- .3 Where specified, clearing to take place outside of the nestling/fledgling time
- .4 All efforts must be made to preserve all top soil/root material to be placed back on the site for a viable seed source.
- .5 Top soil from these areas must be laid down within one season of original excavation.
- .6 All efforts must be made to stay away from any treed area to be preserved. A minimum of 10 meters setback to be measured from the closest tree trunk is required.
- .7 Any preserved areas must be fenced and absolutely no equipment may be operated or parked within the fenced area.

.5 Work Adjacent to Waterways and Preserved Wetlands

- .1 Do not operate construction equipment in waterways.
- .2 Do not use waterway beds for borrow material without the Engineer's approval.
- .3 Do not dump excavated fill, waste material, or debris in waterways.

- .4 Design and construct temporary crossings to minimize erosion to waterways.
 - .5 Do not skid logs or construction materials across waterways.
 - .6 Avoid indicated spawning beds when constructing temporary crossings of waterways.
 - .7 Do not blast under water or within 100m of indicated spawning beds.
 - .8 Where specified, work to take place outside of the nestling/fledgling time.
- .6 Pollution Control
- .1 Maintain temporary erosion and pollution control features installed under this Contract.
 - .2 Control emissions from equipment and plants to local authorities emission requirements.
 - .3 Prevent sandblasting and other extraneous materials from contaminating air beyond application area, by providing temporary enclosures.
 - .4 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

1. GENERAL

This Section includes and clarifies regulatory requirements requested in the Specifications in order to reduce the need to repeat these requirements in applicable Specification Section.

1.1 Regulatory Requirements

.1 General

- .1 The Laws and Regulations of the place where the Work is performed shall govern, in accordance with the General Conditions.
- .2 The Contractor shall ensure compliance on its part and on the part of all of its Subcontractors, with the Occupational Health and Safety Act and Regulations there under.
- .3 Work shall conform to or exceed the minimum standards of the Canadian General Standards Board, the Canadian Standards Association, and the Alberta Building Code or as specified in the documents.
- .4 When specified standards are not dated, conform to the latest issues, as of the date of receipt of Tender.

.2 Waterworks and Sewerage

- .1 The Contractor shall comply with all regulations and recommended standards of Alberta Environment with respect to public health, public water supplies and sewerage systems.

.3 Regulations, Standards and Codes

- .1 Codes, standards, and regulations are specified in other sections of the Specifications and the Work shall be done in accordance with those codes, standards, and regulations where applicable.

.4 Fees, Permits and Certificates

- .1 The Contractor shall obtain all permits, licenses, and certificates required for execution of the work. He shall provide inspection authorities with such plans and information as may be required.

.5 Holidays

- .1 The Contractor shall not work on any Sunday or Statutory Holiday without the Engineer's approval.

.6 Weight Regulations

- .1 The Contractor shall comply with all requirements of the Alberta Traffic Safety Act (T-6 RSA 2000).

1. GENERAL

This Section provides reference to acronyms for Standards, Organizations and Trade Associations used throughout this document, and their general contact information.

1.1 Reference Standards

- .1 Within the text of the Specifications, reference may be made to the following standards:
 - .1 ACI – American Concrete Institute
 - .2 ANSI – American National Standards Institute
 - .3 AASHTO – American Association of State Highway Transportation Officials
 - .4 ASTM – American Society for Testing and Materials
 - .5 AWWA – American Water Works Association
 - .6 CEC – Canadian electrical Code (published by CSA)
 - .7 CAN – National Standard of Canada
 - .8 CAN1 – National Standard of Canada/Canadian Gas Association
 - .9 CAN2 – National Standard of Canada/Canadian General Standards Board
 - .10 CAN3 – National Standard of Canada/Canadian Standards Association
 - .11 CAN4 – National Standard of Canada/Underwriter’s Laboratories of Canada
 - .12 CGSB – Canadian General Standards Board
 - .13 CAN/CSA – National Standard of Canada/Canadian Standards Association
 - .14 CNTA – Canadian Nursery Trades Association
 - .15 CSA – Canadian Standards Association
 - .16 CSPI – Corrugated Steel Pipe Institute

- .17 ECUSR – Electrical and Communication System Regulations, Province of Alberta
- .18 ISA – International Society of Arboriculture
- .19 NBC – National Building Code
- .20 MUTCD – Manual on Uniform Traffic Control Devices (U.S.)
- .21 ULC – Underwriters' Laboratories of Canada
- .22 MUTCD – Manual of Uniform Traffic Control Devices (Canada)
- .2 Conform to these standards, in whole or in part as specifically requested in the Specifications.
- .3 If there is question as to whether any product or system is in conformance with applicable standards with Contract Documents.
- .4 The cost for such testing will be born by the Owner in the event of conformance with Contract Documents or by the Contractor in the event of non-conformance.
- .5 Conform to the latest date of issue of referenced standards in effect on the date of submission of bids, except where a specific date or issue is noted.

1. GENERAL

This Section includes and clarifies the administrative and financial requirements for testing, inspection, and report writing requested in the Specifications in order to reduce the need to repeat these requirements in applicable Specification Sections.

1.1 Related Sections

- | | | |
|----|-----------------------------|------------------|
| .1 | Submittal Procedures | Section 01 33 00 |
| .2 | Common Product Requirements | Section 01 61 00 |

1.2 General

- .1 During the progress of the Work, a sufficient quantity of tests will be performed to determine that materials and installation meet the specified requirements.
- .2 Testing will be in accordance with pertinent codes and regulations.
- .3 General requirements for inspection and testing are specified in this Section. Requirements for tests are also described under various sections of the Specifications.
- .4 Product testing, mill tests, and laboratory reports to demonstrate that materials supplied meet the Specifications are specified under various sections of the Specifications.

1.3 Access to Work

- .1 The Owner and the Engineer shall have access to the Work. If part of the Work is in preparation at locations other than the place of the Work, access shall be given to such work whenever it is in progress.
- .2 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by the Engineer's instructions, or the law of the place of the Work.
- .3 If the Contractor covers or permits to be covered Work that has been designated for special tests, inspections, or approvals before such is made, uncover such Work, have the inspections or tests satisfactorily completed and make good such Work.
- .4 The Engineer may order any part of the Work to be examined if the Work is suspected to be not in accordance with the Contract Documents. If, upon examination, such Work is found not in accordance with the Contract Documents, correct such Work and pay the cost of examination and correction. If such Work is found in accordance with the Contract Documents, the Owner shall pay the cost of examination and replacement.

1.4 Testing Services by the Contractor

- .1 The Contractor shall retain the services of an approved independent testing agency and pay the costs of testing services as follows:
 - .1 Standard Proctor Density tests for borrow materials.
 - .2 Sieve Analysis of sands, and aggregates supplied,
 - .3 Product testing that is required and is specified under various sections of the Specifications.
 - .4 Quality Control tests for precast concrete.
 - .5 Quality control test for hot-mix asphaltic concrete pavement.
 - .6 Mix Designs as required in other sections of the Specifications.
- .2 The testing agency shall supply copies of all test results related to this Contract directly to the Engineer.
- .3 The Contractor shall supply all labour, materials, and equipment, and shall perform tests for linings, coatings, pressure tests, leakage tests, infiltration tests, and all other tests specified under various sections of these Specifications. The Contractor shall conduct all camera tests.

1.5 Testing Services by the Owner

- .1 The Owner will retain and pay for the services of an independent testing agency for sample testing during construction to check quality of the Work. This may include the following and other tests:
 - .1 Standard Proctor, sample density, and moisture content tests for trench backfill, fill, embankment, road sub grade, and granular materials.
 - .2 Quality assurance testing for concrete pursuant to Section 03 30 20 – Cast-In-Place Concrete.
 - .3 Quality assurance testing for asphaltic concrete pursuant to Section 32 12 16 – Hot-Mix Asphalt Concrete Paving.
- .2 The Owner may order and pay for testing of any material or installation in addition to the tests by the Contractor. The Owner's testing will be performed by an independent testing agency.
- .3 The Owner may provide the results of his testing to the Contractor. However, the Contractor should not rely on testing undertaken by the Owner to control his operations.
- .4 Tests conducted by the Owner or his agent are based on random sampling and

shall not be deemed to relieve the Contractor of the responsibility for the quality and maintenance of the Work.

1.6 Contractor's Responsibility for Testing

- .1 The Contractor shall provide facilities for access to the Work in order that testing laboratories may properly perform tests.
- .2 Coordinate with the Engineer, the scheduling of the testing laboratory to enable testing to be carried out as necessary, without undue delays.
- .3 The testing laboratory will take all samples and specimens, and will provide the necessary equipment and personnel to deliver specimens and samples to the laboratory.
- .4 The Contractor shall make good, work disturbed by inspection and testing.
- .5 Pay costs for uncovering and making good Work that is covered before the required inspection or testing is completed and approved by the Engineer.

1.7 Code Compliance Testing

- .1 Inspections and tests required by codes or ordinances, or by a plan approval authority, shall be the responsibility of, and shall be paid for by the Contractor.

1.8 Contractor's Convenience Testing

- .1 Inspections or testing performed exclusively for the Contractor's convenience shall be the sole responsibility of the Contractor.

1.9 Retesting

- .1 When initial tests indicate non-compliance with the Contract Documents, all subsequent retesting because of the non-compliance shall be performed by the same testing laboratory and the costs will be deducted from the Contractor's payments.

1. GENERAL

This Section includes temporary utilities, construction facilities, and temporary controls not incorporated into the final or permanent work.

1.1 Related Sections

- .1 N/A

1.2 Protection

- .1 The Contractor shall protect all trees, water courses, fences, streets, or other structures from damage and make good any damage unless otherwise directed by the Engineer.

1.3 Existing Utilities and Structures

- .1 Excavation in the vicinity of existing structures and utilities shall be carefully performed and any utilities which cross an excavation must be properly supported or shored to prevent settlement. Where trenching is to be done under existing utilities, such utilities shall be shored before excavation commences and shoring shall be left in place. Exposed utilities shall be inspected for damage by the respective utility company before backfilling the trench.
- .2 The existence, location, and/or elevations of underground utilities are not guaranteed, and notwithstanding any other provision in the Contract, the Contractor shall be responsible for determining the location and elevation of all sewer, water, and gas mains or lines; electric light, power, or telephone conduits; or other structures or utilities; and shall pay for any service supplied by the utility company or by any department of the Owner for the location of utilities.
- .3 The Contractor shall indemnify and save harmless the Owner of any such main, line, conduit, or other such structure or utility for any loss or damage which may be suffered by any such Owner because of damage to any such main, line, conduit, or other such structure or utility, in any way caused by the operations of the Contractor in the performance of this Contract.

1.4 Site Storage and Over Loading

- .1 Confine the Work and the operations of employees to limits indicated by the Contract Documents. Do not unreasonably encumber the premises with products.
- .2 Do not load or permit to be loaded any part of the Work with a weight or force that will endanger the Work.

1.5 Construction Parking

- .1 Consult with the Owner regarding provision of on-site parking for construction personnel.

- .2 Parking will be permitted on site, provided it does not disrupt the performance of the Work.

1.6 Hoarding

- .1 Erect hoarding around entire perimeter of site or where indicated on drawings to protect the public, workers, and public/private property from injury or damage.

1.7 Cutting and Patching

- .1 The Contractor shall do all cutting, fitting, or patching of his work that may be required to make its several parts come together properly and fit it to receive or to be received by work of other contractors shown in or reasonably implied by the Contract Documents.

1.8 Clean Up

- .1 Maintain the working area in a clean and orderly manner as the work progresses and upon completion of construction, remove all waste materials and all temporary facilities from the site.
- .2 Haul surplus or salvage materials that are the property of the Owner to the Owner's storage site.
- .3 Remove surplus or salvaged materials belonging to the Contractor from the site.
- .4 Clean haul routes.
- .5 Broom clean paved surfaces, rake clean other ground surfaces.

1. GENERAL

This Section specifies requirements for hauling and haul roads.

1.1 Related Work

- | | | |
|----|--------------------------------|------------------|
| .1 | Traffic Control | Section 01 35 14 |
| .2 | Temporary Construction Signing | Section 01 58 99 |

1.2 Definitions

- .1 Hauling: The process of transporting material from its point of loading to its designated delivery point.
- .2 Haul Roads: A route over which materials are hauled for the performance of the Work, conforming to the following:
 - .1 An approved route from a designated source or waste disposal site.
 - .2 A Contractor selected route from a Contractor supply source or waste disposal site.
- .3 Free Haul: Distance excavated soil or granular material is hauled without additional compensation. Free haul distance to be unlimited.
- .4 Over Haul: Distance excavated soil or granular material is hauled beyond the limits of free haul.

1.3 Maintenance and Restoration of Haul Roads

- .1 The Contractor shall be responsible for all costs associated with the maintenance and restoration of haul roads.

2. EXECUTION

2.1 Hauling

- .1 Haul vehicles shall comply with the Alberta Highway Traffic Act and Public Service Vehicles Act.
- .2 The Contractor shall not haul when hauling operations cause serious hazards or difficulties to the travelling public. These conditions may occur at the following times:
 - .1 when spring thaw is taking place;
 - .2 during or after heavy rainfall; or
 - .3 during period of exceptionally heavy traffic.

- .3 The Contractor shall abide by all load restrictions established by the road or bridge authority having jurisdiction.

2.2 Haul Routes

- .1 Haul roads and hauling equipment to be approved by the Engineer.
- .2 Prior to commencement of haul, haul roads shall be inspected by authorized representatives of the local road authorities, the Contractor, and the Engineer to establish and record the general road condition.
- .3 Haul roads shall be maintained in a condition satisfactory to the Engineer throughout the period in which haul is underway. In the event of dispute as to the degree of maintenance required, the Engineer will be the final authority.
- .4 Provide adequate traffic control and warning signs along haul route to ensure public safety.
- .5 Upon completion of haul, the road shall be restored to a condition equivalent to or better than that which was evident at the time haul commenced. Another inspection will then be carried out by authorized representatives of the local road authorities, the Contractor, and the Engineer. The Engineer will be the final authority in assessing the restoration required.

1. GENERAL

This Section covers the installation, maintenance, and removal of temporary signing and traffic control devices which are specifically related to construction or repair situations and which are generally removed when the Work is complete.

1.1 Related Work

- .1 Traffic Control Section 01 35 14

1.2 Traffic Accommodation Report and Shop Drawings

- .1 The Contractor shall prepare a Traffic Accommodation Report stamped and signed by a Professional Engineer detailing the measures he proposes to use for accommodating traffic throughout the project. Where revisions of traffic patterns are required due to staging of the Work, separate traffic control drawings will be required to clearly identify all detour phases. For staged construction, provide traffic control Drawings numbered consecutively to correspond with identified phases on construction.
- .2 The report shall consist of Drawings detailing the configuration of temporary construction signs and other traffic control devices in the work zone and written confirmation of the methods and procedures to be used by the Contractor to address specific traffic safety related issues or situations at the Work zone.
- .3 The Contractor shall submit the Traffic Accommodation report to the Engineer 14 days prior to the preconstruction meeting for the project or to a schedule agreed to by the Engineer. The Engineer will review the Traffic Accommodation Report and communicate any concerns to the Contractor within seven days of the scheduled meeting. Any issues or concerns regarding the Contractor's proposed Traffic Accommodation Report shall be addressed to the mutual satisfaction of the Contractor and the Engineer prior to the commencement of the Work.

1.3 Public Notices

- .1 The Contractor will prepare a detour drawing and will advise The Town of Sylvan Lake of the upcoming traffic restrictions so that The Town has adequate time to inform Emergency Services and the Media.

2. PRODUCTS

2.1 Materials

- .1 The Contractor shall supply all signing materials, including sign posts, weighted stands, brackets, any mounting hardware, and other miscellaneous materials required for the erection of temporary construction signs.
- .2 All signs, barricades, and other traffic control devices shall conform to the requirement for shape, colour, and size specified in the Manual of Uniform Traffic Control Devices for Canada. The orange portion of all signs shall be fully reflectorized using high brightness, retro reflective, non-metalized, prismatic sheeting material that incorporates durable, transparent, fluorescent pigment.

2.2 Equipment

- .1 The Contractor shall supply all equipment required to complete the Work.

3. EXECUTION

3.1 Erection of Signs

- .1 Work on the project shall not commence until all necessary temporary construction signs and all other construction signs, as proposed in the Traffic Accommodation Report, are in place.
- .2 When signs require frequent moves, portable type signs, mounted on weighted stands, may be used. Portable signs shall be placed on the shoulder of the road such that the face of the sign is fully visible to oncoming traffic and the bottom of the sign is not less than 0.3 m above the road surface. The stand shall be securely weighted and erected to ensure against being blown over by prevailing winds or gusts from passing vehicles.
- .3 Non-portable signs shall be conspicuously posted, and erected at right angles to the roadway, with the bottom of the sign at a height of 1.5m above the road, and not less than 2 m or more than 6m from the nearest traffic lane.
- .4 Traffic signs and devices shall be moved and kept as close to the Work area as practical, as construction proceeds.
- .5 Objects within or immediately adjacent to the roadway, which constitute a hazard to traffic, shall be marked with alternating black and orange stripes attached directly to the object or erected immediately in front of it.

- .6 The use of signs shall be kept to a minimum to prevent confusion.
- .7 “Stop” signs shall be installed as directed by the Engineer.
- .8 Speed zones, where required, shall be posted as indicated on the Traffic Accommodation report drawings. Signs shall indicate the speed limits as ordered by the Engineer.

3.2 Maintenance and Removal of Signs

- .1 Poorly maintained signs, defaced, damaged, or dirty construction signs shall be replaced, repaired, or cleaned without delay. Special care must be taken to ensure that construction materials and dust are not allowed to obscure the face of a sign.
- .2 Signs not in effect shall be covered or removed.
- .3 All construction signs shall be removed after the project is complete.

3.3 Modifications to Existing Temporary Construction Signing

- .1 The Contractor shall be totally responsible for the supply and proper placement of temporary construction signs. However, in the case of potential danger to the public or other circumstances where the Engineer or the Owner determines that the signing is inadequate, the Engineer will require changes to the Contractor's operations to remedy the situation. These changes may involve the use of different types and/or sizes of signs, modifying the number and/or location of signs, or any other modifications or additions required to protect the safety of the public.

3.4 Daily Recording of Temporary Construction Signing

- .1 Each day and as the Work area changes, the Contractor shall record the location of all temporary construction and any other traffic control devices used in the Work areas. The Contractor shall record this information on a form suitable to the Engineer and shall submit it to the Engineer on a weekly basis or when requested.
- .2 In cases where the Contractor is not in compliance with the specifications but, in the opinion of the Engineer, the infraction is not causing imminent danger to the public, the Engineer will use the following escalating process to address the situation:
 - .1 Issue verbal instructions requiring the Contractor to correct the infraction.

- .2 Issue a written warning instructing the Contractor to correct the infraction.
- .3 Issue a written order instructing the Contractor to suspend Work until the infraction is corrected to the satisfaction of the Engineer.

1. GENERAL**1.1 This Section includes:**

- .1 Product quality, availability, storage, handling, protection and transportation.
- .2 Manufacturer's instructions.
- .3 Quality of Work, coordination and fastenings.
- .4 Existing facilities.

1.2 Related Sections

- .1 Quality Control Section 01 45 00

1.3 Reference Standards

- .1 Within the text of each specification section, reference may be made to Reference Standards. A list of organizations who write Standards are listed in Section 01 42 00 – References.
- .2 Conform to these reference standards, in whole or in part as specifically requested in the Specifications.
- .3 If there is question as to whether any product or system is in conformance with applicable standards, the Engineer reserves the right to have such products or systems tested to prove or disprove conformance.
- .4 The cost for such testing will be as specified in Section 01 45 00 - Quality Control.
- .5 Conform to latest date of issue of Reference Standards in effect on date of submission of Bids, except where specific date or issue is specifically noted.

1.4 Quality of Products

- .1 Products, materials, equipment, and articles (referred to as products throughout the Specifications) incorporated in the Work shall be new, not damaged or defective, and of the best quality (compatible with Specifications) for the purpose intended. If requested, furnish evidence as to type, source, and quality of Products provided.

- .2 Defective products, whenever identified prior to the completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is a precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.
- .3 Should any dispute arise as to the Quality or fitness of products, the decision rests strictly with the Engineer based upon the requirements of the Contract Documents.
- .4 Unless otherwise indicated in the specifications, maintain uniformity of manufacture for any particular or like item throughout the building.
- .5 Permanent labels, trademarks, and nameplates on products are not acceptable in prominent locations, except where required for operating instructions or when located in mechanical or electrical rooms.

1.5 Availability

- .1 Immediately upon signing the contract, review product delivery requirements and anticipate foreseeable supply delays for any items. If delays in supply of products are foreseeable, notify the Engineer of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of work.
- .2 In the event of failure to notify the Engineer at commencement of Work and should it subsequently appear that Work may be delayed for such reason, the Engineer reserves the right to substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.

1.6 Storage, Handling and Protection

- .1 Handle and store products in a manner to prevent damage, adulteration, deterioration, and soiling and in accordance with manufacturers' instructions when applicable.
- .2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in the Work.
- .3 Store products subject to damage from weather in weatherproof enclosures.

- .4 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.
- .5 Remove and replace damaged products at own expense and to the satisfaction of the Engineer.

1.7 Transportation

- .1 Pay costs of transportation of products required in the performance of Work.
- .2 Transportation costs of products supplied by the Owner will be paid for by the Owner. Unload, handle and store such products.

1.8 Manufacturer's Instructions

- .1 Unless otherwise indicated in the Specifications, install or erect products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from manufacturers.
- .2 Notify the Engineer in writing of conflicts between the Specifications and manufacturer's instructions, so that the Engineer may establish the course of action.
- .3 Improper installation or erection of products, due to failure in complying with these requirements, authorized the Engineer to require removal and re-installation at no increase in Contract Price.

1. GENERAL**1.1 General**

- .1 Maintain the working area in a clean and orderly manner as the work progresses and upon completion of construction, remove all waste materials and all temporary facilities from the site.
- .2 Haul surplus or salvage materials that are the property of the Owner to the Owner's storage site.
- .3 Remove surplus or salvaged materials belonging to the Contractor from the site.
- .4 Clean haul routes.
- .5 Broom clean paved surfaces, make clean other ground surfaces.
- .6 When using a mechanical cleaner / sweeper, etc., protect surrounding property and fixtures from flying debris.
- .7 When cleaning up granular based material, do not allow material to enter the storm drainage system.
- .8 Do not allow foreign or contaminated material to enter the storm drainage system.
- .9 Contaminated material to be disposed of at an approved landfill site or other approved disposal site.
- .10 Non-reusable material to be disposed of at a certified landfill site or other approved site.

Section 02 41 14	Asphalt Pavement Removal
Section 02 41 43	Site Demolition

1. GENERAL

This Section specifies requirements for the removal of asphalt and the preparation for replacement.

1.1 Related Sections

.1	Clearing	Section 01 74 11
.2	Reshaping Granular Roadbed	Section 32 11 13
.3	Asphalt Concrete Overlay Paving	Section 32 12 50
.4	Reshaping Asphalt Pavement (Milling)	Section 32 12 53

1.2 Measurement Procedures

- .1 Removal of existing asphalt pavement will be measured in square meters of surface actually removed regardless of depth removed or number of operations required.
- .2 Payment under this item will include operations involved in removing, hauling and stockpiling designated pavement and cleaning of remaining pavement surface.
- .3 New granular base material shall be measured in tonnes of material incorporated in work and based on weigh tickets as submitted to the Engineer with each lead installed.

1.3 Waste Management and Disposal

- .1 Separate waste materials for reuse and recycling.
- .2 Divert unused asphalt materials from landfill to local facility approved by the Engineer.

2. PRODUCTS

2.1 Equipment

- .1 Use cold milling, planning or grinding equipment with automatic grade controls capable of operating from string line, and capable of removing part of pavement surface to depths or grades indicated.
- .2 Use equipment capable of full depth and width removal where required.

3. EXECUTION

3.1 Preparation

- .1 Prior to beginning removal operation, inspect and verify with the Engineer areas, depths and lines of asphalt pavement to be removed.

3.2 Protection

- .1 Protect existing pavement, concrete and protruding utility infrastructure damage. In event of damage, immediately replace or make repairs to the approval of the Engineer at no additional cost.

3.3 Removal

- .1 Remove existing asphalt pavement to lines and grades established by the Engineer in field.
- .2 Use equipment and methods of removal and hauling which do not damage or disturb underlying pavement or granular base course.
- .3 Prevent contamination of removed asphalt pavement by topsoil, underlying gravel or other materials.
- .4 Provide for suppression of dust generated by removal process.

3.4 Stockpiling of Material

- .1 Dispose of removed asphalt pavement by stockpiling in locations designated by the Engineer.
- .2 Removed asphalt which is to be recycled in hot mix asphalt concrete may be stockpiled at site designated by the Engineer.

3.5 Finish Tolerances

- .1 Finished surfaces in areas where asphalt pavement has been removed to be within +/- 5mm of grade specified, but not uniformly high or low.

3.6 Sweeping

- .1 Sweep remaining asphalt pavement surfaces clean of debris resulting from removal operations using rotary power broom and hand broom as required.

1. GENERAL

This Section specifies requirements for demolishing, salvaging, and removing wholly or in part, various items designated to be removed or partially removed and for backfilling resulting trenches, holes and pits.

1.1 Related Work

.1	Clearing and Grubbing	Section 31 11 00
.2	Site Grading	Section 31 22 30
.3	Trench Excavation and Backfilling	Section 31 23 16
.4	Roadway Embankment and Compaction	Section 31 24 13

1.2 Protection

- .1 Protect in accordance with:

Section 31 11 00	Clearing and Grubbing
Section 31 23 16	Trench Excavation and Backfilling
Section 31 24 13	Roadway Embankment and Compaction
- .2 Protect existing items designated to remain and materials designated for salvage. In the event of damage to such items, immediately replace or make repairs to approval of the Engineer and at no cost to the Owner.

1.3 Solid Waste Disposal

- .1 Surplus excavated material may be taken to the Town's storage site (subject to prior approval) or disposed of offsite.

1.4 Measurement for Payment

- .1 Concrete items specified as "remove and replace" shall be measured and paid to Section 32 13 14 – Removal and Replacement of Concrete Work.
- .2 Payment for saw cutting will be made at the unit price tendered, within the depth ranges specified per lineal metre of saw cutting. Horizontal measurement shall be measured as the surface length of cut. Vertical depth shall be based on the average depth measured at intervals determined by the Engineer.
- .3 Removal of pavement will be measured in square metres regardless of thickness.
- .4 Removal of granular base and sub-base materials will be measured in cubic metres in place.
- .5 Removal of concrete work will be measured as follows:

- .1 Monolithic curb, gutter, and sidewalk to be measured in square metres.
- .2 Separate sidewalk to be measured in square metres.
- .3 Curb and gutter to be measured in lineal metres.
- .4 Curb to be measured in lineal metres.
- .5 Miscellaneous concrete work removal to be measured as shown in the Schedule of Quantities.
- .6 Removal of culverts, pipe sewers, and drains will be measured in metres regardless of diameter. End points of measurements will be at centres of manholes or catch basins or open ends of pipes, as applicable.
- .7 Removal of manholes and catch basins will be measured in units.
- .8 Removal of cable duct banks, regardless of number of ducts in each bank, will be measured in metres from end to end of duct bank for each size.
- .9 Removal of fences and guard rails will be measured in metres.
- .10 Salvage, stockpiling, sealing, disposal, excavating, backfilling, and restoration will not be measured. Payment for these items will be included in above removal items.

2. EXECUTION

2.1 Preparation

- .1 Inspect site and verify with the Engineer items designated for removal and items to remain.
- .2 Locate and protect utility lines. Preserve in operating condition active utilities traversing site.
- .3 Notify utility companies before starting demolition.

2.2 Saw Cutting

Saw cuts are to be made with a concrete or asphalt saw capable of providing a true straight joint of consistent depth, as specified. Sawcuts in concrete work are to be made at a construction or surface joint at each end of the designated repair area. Sawcuts in asphalt adjacent to designated areas of concrete removal shall be parallel to the edge of concrete work at a minimum distance of 200 mm and a maximum distance of 500 mm from the lip of gutter.

2.3 Removal

- .1 Remove items as indicated.

- .2 Do not disturb adjacent items designated to remain in place.
- .3 In removal of pavements, curbs and gutters:
 - .1 Square up adjacent surfaces to remain in place by saw cutting or other method approved by the Engineer.
 - .2 Protect adjacent joints and load transfer devices.
 - .3 Protect underlying granular materials.
 - .4 When removing curbs and gutters adjacent to pavements, sawcut as per Clause 2.2 of this Section and remove asphalt and granular material in order to complete form work.
- .4 When removing pipes under existing or future pavement area, excavate at least 300 mm below pipe invert.

2.4 Salvage

- .1 Carefully dismantle items containing materials for salvage and stockpile salvaged materials at locations as indicated or as directed by the Engineer.

2.5 Sealing

- .1 Seal pipe ends and walls of manholes or catch basins as indicated or as directed by the Engineer. Securely plug to form watertight seal.

2.6 Disposal of Material

- .1 Dispose of materials not designated for salvage or re-use in work, on-site or off-site as directed by the Engineer.
- .2 Trim disposal areas to the approval of the Engineer.

2.7 Restoration

- .1 Upon completion of work, remove debris, trim surfaces, and leave work site clean.
- .2 Re-instate areas and existing works outside areas of demolition to conditions that existed prior to commencement of work, as outlined in specific sections for each type of work.

Section 03 05 13	Basic Concrete Materials and Test Methods
Section 03 10 00	Concrete Formwork
Section 03 12 10	Slip Formed Concrete
Section 03 20 10	Concrete Reinforcement
Section 03 30 20	Cast-In-Place Concrete
Section 03 48 23	Precast Concrete Parking Curbs

1. GENERAL**1.1 Related Work**

- | | | |
|----|--------------------------|------------------|
| .1 | Concrete Reinforcement | Section 03 20 10 |
| .2 | Concrete Work | Section 32 13 15 |
| .3 | Manholes and Catchbasins | Section 33 05 12 |

1.2 Reference Standards

- .1 Supply of ready-mixed concrete in accordance with CAN3-A23.1 and testing of ready-mixed concrete in accordance with CAN3-A23.2 except where specified otherwise.

2. PRODUCTS**2.1 General**

Concrete shall consist of the following components:

- | | |
|----|--|
| .1 | Aggregates |
| .1 | Coarse aggregate: greater than 5 mm particle size; |
| .2 | Fine aggregate: less than 5 mm particle size of natural or approved manufactured sand. |
| .2 | Paste |
| .1 | Portland Cement; |
| .2 | Supplementary cementing materials; |
| .3 | Water; |
| .4 | Air-entraining admixture; |
| .5 | Additional admixtures where permitted by the Engineer. |

2.2 Aggregate Materials

.1 General

- .1 Upon request by the Engineer and prior to establishing a source of aggregates, the Contractor shall have the aggregate sampled at the source of supply by the Town's appointed testing firm. The source of supply will be approved if the samples submitted meet the requirements of these Specifications.
- .2 Records of the testing of all aggregates used for the production of concrete must be maintained and be disclosed to the Engineer upon request.

.2 Fine Aggregate

- .1 Fine aggregate shall meet the requirements of CSA CAN3-A23.1 except as modified by the following paragraphs:
- .2 Fine aggregate shall be natural sand or approved manufactured sand, washed clean, having hard, strong, sharp, durable uncoated grains, and shall be free from injurious amounts of dust, lumps, soft or flaky particles, mica, shale, alkali, organic matter, loam, or other deleterious substance. Sand shall be tested for impurities by colorimetric test in conformity with CSA Test Method 123.2-7A and sand giving a colour darker than the reference standard colour will be subjected to CSA Test Method A23.2-4A to determine its acceptability.
- .3 Aggregate sizing shall conform to CSA CAN3-A23.1:

<u>SIEVE SIZE</u>	<u>TOTAL PASSING SIEVE % BY MASS</u>
10 mm	100
5 mm	95 - 100
2.5 mm	80-100
1.25 mm	50-90
630 um	25-65
315 um	10-35
160 um	2-10

- .4 Should the necessity for frequent rejections occur, no further sand will be accepted from that source and another approved source will be required.

.3 Coarse Aggregate

- .1 Coarse aggregate shall conform to the requirements of CSA CAN3-A23.1 except as modified by the following paragraphs:
- .2 Coarse aggregate shall consist of gravel or broken stone composed of strong, hard, durable uncoated pebbles, or rock fragments, washed clean

and free from injurious amounts of shale, coal, clay, lumps, soft fragments, dirt, glass, and organic, or other deleterious substances.

- .3 Aggregate sizing shall conform to CSA CAN3-A23.1, Section 5, Table 3, Group 1 (28-5):

<u>SIEVE SIZE</u>	<u>% PASSING BY WEIGHT</u>
40 mm	100
28 mm	95-100
14 mm	30-65
5 mm	1-10
2.5 mm	0-5

- .4 Aggregates shall be kept clean and free from all other materials during transportation and handling. The aggregates shall be kept separated from each other at the Site, until measured and placed in the mixer.

2.3 Portland Cement and Concrete Materials

.1 General

- .1 Portland Cement shall conform to CSA-A3001 for the following types:

<u>NAME</u>	<u>TYPE</u>
General Use	GU
High Early Strength	HE
High Sulphate Resistant	HS

- .2 The cement manufacturer's mill test reports must be submitted to the Engineer upon request.

.2 Air-Entraining Admixture

- .1 An air-entraining admixture conforming to ASTM C260 must be added to the batch independently. Sufficient air-entraining admixture shall be added to produce the air content specified, at the time of placing in the forms. No additional payment will be made for the use of air-entraining admixture.

.3 Water Reducing Admixture

- .1 Water reducing admixture, if approved, shall conform with the requirements of ASTM C494. Before using a water-reducing admixture the concrete supplier shall furnish evidence that it will be compatible with the brand of air-entraining admixture he proposes to use. No additional payment will be made for the use of water reducing admixture.

.4 Calcium Chloride Admixture

- .1 Calcium chloride conforming to ASTM C494 shall only be used when approved by the Engineer, but in no case will the amount added be greater than 2% of the cement weight. It shall not be used when the air temperature is above 4°C.

.5 Use of Chemical Admixtures in Concrete

- .1 The use, chemical composition and classification of admixtures, the effects of admixtures, and the application of admixtures for use in concrete shall be as detailed in ASTM C494. Use of chemical admixture must be approved by the Engineer. No additional payment will be made for the use of chemical admixtures unless approved by the Engineer.

.6 Water

- .1 Water conforming to CSA CAN3-A23.1 to be used, and shall be furnished from sources approved by the Engineer. The Contractor shall make his own arrangements for the supply and payment of all water used on the work.

.7 Supplementary Cementing Materials

- .1 Pouolanic mineral or fly ash shall conform to the requirements of CSA CAN3-A3001, Cementitious Materials and their use in Concrete Construction. Fly ash to be Type C or Type F. No additional payment will be made for the use of pouolanic mineral or fly ash.

.8 Synthetic Reinforcing Fibres

- .1 Synthetic reinforcing fibres such as fibremesh or equivalent may be used as an alternative to steel wire mesh upon written approval of the Engineer.
- .2 Synthetic reinforcing fibres shall meet the following specifications:
 - .1 To be used with Class B or C Concrete only.
 - .2 Fibre shall be polypropylene.
 - .3 Fibre tensile strength shall be a minimum of 550 MPa.
 - .4 Fibre content shall be a minimum of 1 kg/cubic metre.
 - .5 Fibre length shall be the following:

Fibre Length	Aggregate top size
50 mm	40 mm
50 mm	25 mm
38 mm	15 mm

2.4 Concrete Mix Design

- .1 An independent testing firm shall prepare concrete mix designs which will be submitted to the Engineer for each source of concrete supply prior to the commencement of the Contract. Concrete suppliers may submit their own mix designs, provided they submit documentation to show that they have been approved by an independent testing firm.
- .2 Trial mixes shall be prepared in the batch plant and/or truck mixed in accordance with The Town of Sylvan Lake Concrete Specifications. In each case where there is a change in the materials used, a new trial mix will be required.
- .3 Concrete supplied shall conform with the following minimum requirements:

**TABLE A
CONCRETE DESIGN REQUIREMENTS**

Concrete Class	Concrete Uses	Concrete Strength (MPa)	Air Content (%)	Maximum Slump (mm)	Cement Type	Maximum Flyash Content (%)	Maximum Water/Cement Ratio by	Minimum Portland Cement Content
A	Traffic Davit Base	30	6 - 8	80	10, 50	20	0.45	325
B	Sidewalk, Curb and Gutter (Winter Use)	30	6 - 8	80	10, 50	0	0.45	350
C	Sidewalk, Curb and Gutter	27.5	6 - 8	80	10, 30, 50	20	0.45	300
D	Manhole and Catch-basin Bases and Benching, Thrust Blocks, Class A Bedding and Underground Ducts	25	6 - 8	80	50	20	0.5	275
E	Lean Concrete Slurry Mix for Road Repairs	5 - 10	5 - 7	150	10	20	N/A	150
F	Fill Concrete for Trench Backfill	0.5	4 - 6	150	10	20	N/A	25

- .4 Minimum Allowable Compressive Strength Corresponding to Percentage of Entrained Air
 - .1 Notwithstanding the Concrete Strength Requirements outlined in Table 1 for Classes A, B, and C Concrete, the minimum allowable compressive strengths may be reduced corresponding to the percentage of air entrained in plastic concrete as follows:

TABLE B
MINIMUM ALLOWABLE COMPRESSIVE STRENGTH
CORRESPONDING TO PERCENTAGE OF ENTRAINED AIR

% Air Content	Class "A" & "B" Allowable Concrete Strength (MPa)	Class "C" Allowable Concrete Strength (MPa)
6.0 - 6.5	30.0	27.5
6.6 - 7.0	29.2	26.7
7.1 - 7.5	28.3	25.8
7.6 - 8.0	27.5	25.0

3. EXECUTION

3.1 Seasonal and Cold Weather Requirements

- .1 Seasonal and cold weather requirements shall conform to the requirements of CSA CAN3 A23.1-21.2.3 unless specified otherwise.
- .2 Concrete placed between April 16 and September 15 shall attain the minimum allowable compressive strength in 28 days. For concrete placed between September 16 and April 15, 85% of the minimum allowable compressive strength shall be attained in 7 days.
- .3 When the air temperature is at or below 4°C or is likely to drop below 4°C within 24 hours of placing concrete, the temperature of the concrete immediately after being deposited in the forms, is not less than 16°C nor more than 32°C. To accomplish this, the mixing water, and if necessary the fine aggregates, shall be heated. Aggregates shall not be heated above 65°C and all frozen lumps of aggregate shall be excluded from the mix. When the exposure is severe, either due to low air temperature, location of the work, or thin sections of concrete, the temperature of the concrete shall approach the higher 32°C limit.
- .4 To avoid the possibility of flash set when either water or aggregate is heated to a temperature in excess of 38°C, water and aggregate shall come together first in the mixer in such a way that the temperature of the combination is reduced to below 38°C before cement is added. For mass concrete, the minimum temperatures stated above may be reduced at the discretion of the Engineer.

3.2 Testing Procedures and Specifications

- .1 Concrete supplied for this Contract will be tested by a recognized testing laboratory appointed by the Engineer which will test according to CSA A23.2 testing procedures unless otherwise specified for the following:
 - .1 Methods of Test for Concrete: CSA A23.2
 - .2 Sampling of plastic concrete: CSA A23.2-1C

- .3 Making and curing concrete compressions and Flexural test specimens
CSA A23.2-3C
 - .4 Air Content of plastic concrete by pressure method: CSA A23.2-4C
 - .5 Slump of concrete: CSA A23.2-5C
 - .6 Density, yield, and cement factor of plastic concrete: CSA A23.2-6C
 - .7 Compressive strength of cylindrical concrete specimens: CSA A23.2-9C
 - .8 Obtaining and testing drilled cores for compressive CSA A23.2-14C
 - .9 Recommended practice for Microscopical Determination of Air-Void
content and parameters of the Air-Void system in hardened concrete:
ASTM C457
-
- .2 Where reference is made to an A.S.T.M. designation or a CSA standard, the
current standard applies.
 - .3 There shall be at least one strength test, slump test, and air content test, for each
50 cubic metres of concrete, or fraction thereof, and in any event, not less than
one test for each class of concrete used each. For the purposes of this Section,
each test shall represent the total volume of concrete placed on the day the test
cylinders were cast, divided by the number of tests taken that day for each class of
concrete.
 - .4 When making tests on fresh concrete, not less than three specimens for each test
shall be moulded for compressive tests. One cylinder is to be tested at seven days
and two at 28 days. The Engineer may require more tests than outlined above.
 - .5 When the temperature is below 0°C during concrete placement, or is likely to fall
below 0°C within 24 hours after a placement, two additional cylinders will be
made for each test. These two cylinders will be field cured in a manner that
simulates curing of the concrete placed.
 - .6 A minimum of two field cured cylinders will be required for any cast-in-place
concrete which is to be post-tensioned.
 - .7 The Contractor shall give the Engineer 24 hours notice prior to any concrete
placement or any work requiring testing in order that the Engineer may arrange for
required testing. The Engineer shall be reimbursed by the Contractor for any
charges to the Engineer by testing agency as a result of testing agency being called
out prematurely or as a result of having to wait for the Contractor for any reason.
 - .8 The foregoing does not apply to preparation of concrete mix designs for projects
which the Contractor shall engage an independent testing agency. Cost of such
mix design shall be borne by the Contractor. Copies of mix designs shall be
submitted to the Engineer for approval, however, such approval does not

constitute acceptance of final product which shall meet requirements set forth elsewhere in this Section.

- .9 If testing indicates substandard materials and workmanship, further testing, as approved by the Engineer, shall be completed at the Contractor's expense.
- .10 The Contractor shall supply, as part of the Contract, all materials, scaffolding, labour, etc. required to facilitate testing services on a job site.

3.3 Testing Reports

- .1 Reports for concrete testing shall contain the following information:
 - .1 Job to which concrete is being supplied
 - .2 Date of sampling
 - .3 Air temperature when sampling
 - .4 Temperature of mix
 - .5 Name of supplier
 - .6 Exact location in which the concrete is being placed
 - .7 Specimen number
 - .8 Test number
 - .9 Slump
 - .10 Age of test
 - .11 Cylinder strength
 - .12 Method of curing
 - .13 Air content
 - .14 Type of cement

3.4 Defective Work

- .1 Concrete is defective when:
 - .1 It fails to meet any requirement of this specification.
 - .2 Average of two 28 day strength tests from one set of cylinders is less than the specified strength.

- .2 When concrete strength of any set of cylinders is greater than 85% but less than 100% of specified strength, price paid for work represented by deficient cylinders shall be determined as follows:

$$\text{Payment Amount} = P \times \left(1 - \frac{2(A-B)}{A}\right)$$

Where P = Unit Price bid for concrete work

A = Specified strength

B = Average of two cylinders 28 day strength

If strength is less than 85% of specified strength, concrete shall be removed and replaced at the Contractor's expense.

- .3 All concrete which fails to meet any requirement of this specification will be removed and replaced at the Contractor's expense.
- .4 The application of an adjusted unit price does not relieve the Contractor of the Contract maintenance requirements.

3.5 Supply and Delivery of Concrete

.1 Mixing and Delivery

- .1 Ready mixed concrete shall be mixed and delivered in accordance with the requirements of A.S.T.M. designation C-94, CSA A23.1.3 and subject to all provisions herein relative to materials, strength, proportioning, consistency, measurement and mixing unless noted otherwise.
- .2 If concrete placing is interrupted for a period of more than one-half hour, the work shall be removed back to the last surface cut and a construction joint shall be formed.

.2 Retempering

- .1 Concrete shall not be retempered if test values are within specifications at the time of delivery to the site.
- .2 Concrete may be retempered at the job site with water and/or an air-entraining admixture if the following requirements are met:
- .1 Mixing time after the admixture or water has been introduced shall not be less than five minutes at mixing speed.
- .2 Total mixing and agitating time for the load shall not exceed 90 minutes or 300 revolutions of the drum.

1. GENERAL

This Section specifies the requirements for formwork in conjunction with concrete work. All formwork to be designed and stamped by a professional structural engineer licensed in Alberta. Design formwork to safely support all vertical and lateral loads and in accordance with ACI 347R, CSA-O86, CAN/CSA-S16, CSA-S269.1 and CAN/CSA-S269.3.

2. PRODUCTS

2.1 Materials

- .1 Formwork materials: wood and steel formwork materials, as approved by the Consulting Engineer or a professional engineer licensed to practice structural engineering in Alberta.
- .2 Tubular column forms: round, spirally wound laminated fibre forms, internally treated with release material.
- .3 Form ties: removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 24 mm diameter in concrete surface.
- .4 Form release agent: chemically active release agents containing compounds that react with free lime present in concrete to provide water insoluble soaps, preventing concrete from sticking to forms.
- .5 Form stripping agent: colourless mineral oil, free of kerosene, with viscosity between 70 and 110s Saybolt Universal at 40° C, flashpoint minimum 150°C, open cup.

3. EXECUTION

3.1 Erection

- .1 Verify lines, levels, and column centres before proceeding with formwork and ensure dimensions agree with drawings.
- .2 Hand trim sides and bottoms and remove loose earth from forms before placing concrete.
- .3 Construct forms to produce finished concrete conforming to shape, dimensions, locations, and levels indicated within tolerances required by CAN/CSA-A23.1.
- .4 Clean formwork in accordance with CAN/CSA-A23.1, before placing concrete.
- .5 Remove formwork in accordance with CAN/CSA-A23.1.
- .6 Re-use of formwork subject to requirements of CAN/CSA-A23.1.

1. GENERAL

This Section specifies requirements for use of slip-form machines for concrete curbs, curbs and gutters, and sidewalks.

1.1 Related Work

.1	Concrete Reinforcement	Section 03 20 10
.2	Cast-in-Place Concrete	Section 03 30 20
.3	Concrete Work	Section 32 13 15

2. PRODUCTS

2.1 Materials

- .1 Concrete to Section 03 30 20 – Cast-in-Place Concrete, with 50 mm maximum slump.
- .2 Reinforcement to Section 03 20 10 – Concrete Reinforcement.

3. EXECUTION

3.1 Equipment

- .1 Subgrade trimmers: self-powered trimmers capable of producing a clean smooth surface true to line and grade indicated. Remaining loose material on subgrade not to exceed 6 mm in depth.
- .2 Concrete extruders: self-powered extruders with automatic line and grade control capable of placing consolidating, screeding and float finishing in one pass.

3.2 Execution

- .1 Operate concrete extruder continuously until section or scheduled pour completed. Empty hopper of concrete and construct joint containing two 1.2 m 10M deformed steel bars when operations delayed more than 30 minutes.
- .2 Vibrate concrete to obtain a dense, smooth finished mass.
- .3 Finishing handwork to be minimized. Concrete requiring excessive hand finishing to be rejected.
- .4 Construct joint containing two 1.2 m 10M deformed steel bars at end of each section of extruded concrete.
- .5 Areas of concrete to be formed and placed by hand shall be completed within 7 days of completion of adjacent extruded section.

1. GENERAL**1.1 Related Work**

- .1 Cast in Place Concrete Section 03 30 20

1.2 Reference Standards

- .1 Do reinforcing work in accordance with CAN3-A23.1 and welding of reinforcing with CAN3-W186, except where indicated otherwise.

1.3 Test Reports

- .1 Upon request, provide the Engineer with certified copy of mill test report of steel supplied, showing physical and chemical analysis.

1.4 Shop Drawings

- .1 Submit Shop Drawings.
- .2 Clearly indicate bar sizes, spacing, location, and quantities of reinforcement, mesh, chairs, spacers and hangers with identifying code marks to permit correct placement with out reference to structural drawings.
- .3 Detail placement of reinforcing where special conditions occur.
- .4 Design and detail lap lengths and bar development lengths to CAN3-A23.3, unless otherwise specified on drawings.

1.5 Storage and Hauling

- .1 Ship bar reinforcement in standard bundles easily identifiable and marked in accordance with bar lists.
- .2 Store reinforcement to prevent deterioration or contamination by dirt, detrimental rust, loose scale, paint, oil, or other foreign substances that will destroy or reduce bond.
- .3 Do not straighten or rebend reinforcement in any manner.
- .4 Do not use bars kinked or bent by improper handling or storage.

2. PRODUCTS

2.1 Materials

- .1 Reinforcing bars: billet steel, grade deformed bars to CAN3-G30.12 unless indicated otherwise - 400 grade.
- .2 Reinforcing bars: weldable low alloy steel deformed bars to CAN3- G30.16.
- .3 Cold-drawn steel wire for concrete reinforcement to CAN3-G30.3.
- .4 Welded steel wire fabric to CAN3-G30.5.

2.2 Fabrication

- .1 Fabricate reinforcing to CAN3-A23.1.
- .2 Obtain the Engineer's approval for location of reinforcement splices other than shown on steel placing Drawings.
- .3 Ship bundles of bar reinforcement, clearly identified in accordance with bar list.

3. EXECUTION

3.1 Placing Reinforcement

- .1 Place reinforcing steel to CAN3-A23.1 and as indicated on reviewed Shop Drawings.
- .2 Obtain the Consulting Engineer's approval of reinforcing steel and position before placing concrete.
- .3 Clean reinforcing before placing concrete.

1. GENERAL

1.1 Related Work

.1	Basic Concrete Materials and Test Methods	Section 03 05 13
.2	Concrete Formwork	Section 03 10 00
.3	Concrete Reinforcement	Section 03 20 10
.4	Concrete Work	Section 32 13 15
.5	Manholes and Catchbasins	Section 33 05 12

1.2 Reference Standards

- .1 Do cast-in-place concrete work in accordance with CAN3-A23.1 except where specified otherwise.

2. PRODUCTS

2.1 Materials

- .1 See Section 03 05 13 – Basic Concrete Materials and Test Methods, for ready-mixed concrete material specifications.
- .2 Non-shrink grout: premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents, of pouring consistency, capable of developing compressive strength of 50 MPa at 28 days.
- .3 Dry pack: premixed or non-premixed composition of non-metallic aggregate, cement and sufficient water for mixture to retain its shape when made into a ball by hand and capable of developing compression strength of 50 MPa at 28 days.
- .4 Curing compound to ASTM C309 and containing a fugitive dye, sufficiently free from permanent colour to result in no pronounced colour change from natural concrete.
- .5 Formwork material: refer to Section 03 10 00 - Concrete Formwork.
- .6 Form stripping agent: refer to Section 03 10 00 - Concrete Formwork.

2.2 Concrete Mixes

- .1 See Section 03 05 13 – Basic Concrete Materials and Test Methods, for concrete mix design requirements.
- .2 Mix design to be completed by an approved materials testing agency and submitted to the Engineer for approval two weeks prior to concrete being placed.

- .3 Provide certification that mix proportions selected will produce concrete of specified quality and yield and that strength will comply with CAN3-A23.1, Clause 17.5, unless specified otherwise.
- .4 Obtain the Engineer's approval before using chemical admixtures other than those specified.

3. EXECUTION

3.1 Workmanship

- .1 Obtain the Engineer's approval before placing concrete. Provide 24 hours notice prior to placing of concrete.
- .2 Place concrete in accordance with CAN3-A23.1.
- .3 Ensure reinforcement and inserts are not disturbed during concrete placement.
- .4 Obtain the Engineer's approval of proposed method for protection of concrete during placing and curing in adverse weather, prior to placing of concrete.
- .5 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, and air temperature.

3.2 Inserts

- .1 Set sleeves, ties, anchor bolts, pipe hangers, and other inserts, openings and sleeves, in concrete floors and walls, as required by other trades. Sleeves, openings, etc., greater than 100 mm x 100 mm not indicated on structural Drawings must be approved by the Engineer.

3.3 Extreme Weather Concrete Work

- .1 Hot weather: conform to requirements of CAN3-A23.1 for hot weather protection when air temperature is at or above 25° C.
- .2 Cold weather: conform to requirements of CAN3-A23.1 for cold weather protection when air temperature at or below 5°C. Concrete not to be placed on frozen subgrade or subbase. Maintain air temperature of 18° C for three days by use of insulation or hoarding and heating around concrete.

3.4 Finishing

- .1 Floated Surface Finish
 - .1 Strike off the compacted concrete to the cross section and elevation shown on drawings. Keep a slight excess of concrete in front of screed at all times.
 - .2 Obtain a uniform surface by floating as necessary. If floating is not

completed before excess water appears at the surface, remove this water before continuing with floating.

- .3 Add or remove concrete during floating as required to obtain a surface with no more than 3 mm deviation from the required surface in any 3 m length.
- .4 Do not overwork concrete surface. Float only enough to obtain a dense uniform surface.

.2 Broomed Finish

- .1 After completion of 3.4.1 above, broom to produce a non-slip surface with regular corrugations not more than 3 mm deep.

.3 Trowelled Finish

- .1 After completion of 3.4.1 above, trowel to produce a dense smooth finish.

.4 Surface Hardener

- .1 Apply according to manufacturer's instructions in conjunction with floating operations.

.5 Curing Compound

- .1 For curb, gutter, sidewalk, and other exposed concrete, a curing compound shall be uniformly sprayed, applied immediately on completion of finishing of surface.

3.5 Testing

- .1 See Section 03 05 13 – Basic Concrete Materials and Test Methods, for testing requirements, specifications, and defective work.

1. GENERAL

This Section specifies requirements for precast concrete parking curbs.

1.1 Measurement for Payment

- .1 Supply and installment of precast parking curbs to be measured in units of each type and size specified or indicated.

2. PRODUCTS**2.1 Materials**

- .1 Cement to CAN3-A3001, type GU grey white.
- .2 Water and aggregates to CAN3-A23.1.
- .3 Air entraining admixture to CAN3-A266.1.
- .4 Reinforcing steel to CAN3 G30.12, deformed, Grade 400, unless indicated otherwise.
- .5 Concrete to CAN3-A23.1, a minimum of 30 MPa compressive strength at 28 days, for Class A exposure.
- .6 Curb anchors: steel dowels or pins to CAN3 G30/12, minimum 15 mm diameter x 60 mm length.

2.2 Fabrication

- .1 Fabricate to CAN3-A23.4, precast reinforced concrete curbs and New Jersey traffic barriers as shown on Drawings.
- .2 Finish being standard grade.
- .3 Fabricate to location, size and dimension as show on Drawings.

3. EXECUTION

3.1 Installation.

- .1 Install curbs as indicated or directed.
- .2 Secure curbs in position by driving steel dowels through precast holes until flush with top of curb.
- .3 Rejected, damaged, or defective units shall be removed from site and replaced with sound units.

Section 31 05 17	Aggregate Materials
Section 31 05 17	Table A: Aggregate Gradation
Section 31 11 00	Clearing and Grubbing
Section 31 22 30	Site Grading
Section 31 23 16	Trench Excavation and Backfilling
Section 31 24 13	Roadway Embankment and Compaction
Section 31 26 13	Reshaping Roadway Sub-grade
Section 31 32 20	Geo-grid Soil Reinforcement
Section 31 32 21	Geotextiles
Section 31 32 41	Soil Insulation
Section 31 36 10	Gabions
Section 31 37 10	Rip-Rap

1. GENERAL

This Section specifies general requirements for supplying and processing of aggregates to be stockpiled or incorporated into work. Specific requirements for physical properties of aggregates are given in related work sections.

1.1 Related Work

.1	Basic Concrete Materials and Test Methods	Section 03 05 13
.2	Cast in Place Concrete	Section 03 30 20
.3	Trench Excavation and Backfilling	Section 31 23 16
.4	Roadway Embankment and Compaction	Section 31 24 13
.5	Granular Sub-Base	Section 32 11 19
.6	Granular Base	Section 32 11 23
.7	Hot-Mix Asphaltic Concrete Paving	Section 32 12 16

1.2 Source Approval

- .1 Source of materials to be incorporated into work or stockpiled requires approval.
- .2 Inform the Engineer of proposed source of aggregates and provide access for sampling at least two weeks prior to commencing production.
- .3 If, in opinion of the Engineer, materials from proposed source do not meet or cannot reasonably be processed to meet specified requirements, procure an alternative source or demonstrate that material from source in question can be processed to meet specified requirements.
- .4 Should a change of material source be proposed during work, advise the Engineer two weeks in advance of proposed change to allow sampling and testing.
- .5 Acceptance of a material at source does not preclude future rejection if it is subsequently found to lack uniformity or if it fails to conform to requirements specified or if its field performance is found to be unsatisfactory.

1.3 Production Sampling

- .1 Aggregate will be subject to continual sampling during production.
- .2 Provide the Engineer with ready access to source and processed material for purpose of sampling and testing.
- .3 Bear the cost of sampling and testing of aggregates in order to meet design

gradations and specifications.

1.4 Measurement for Payment

- .1 No measurement to be made under this section. Include costs in items of work that require aggregates.

2. PRODUCTS

2.1 General

- .1 Aggregate shall be sound, hard, durable material free from soft, thin, elongated, or laminated particles, organic material, or other deleterious substances.
- .2 Flat and elongated particles are those whose greatest dimension exceeds five times their least dimension.
- .3 Fine aggregates satisfying requirements of applicable section shall be one, or a blend of following:
 - .1 Natural sand.
 - .2 Manufactured sand and/or fines.
 - .3 Screenings produced in crushing of quarried rock, boulders, gravel or slag.
- .4 Coarse aggregates satisfying requirements of applicable section shall be one of following:
 - .1 Crushed rock or slag.
 - .2 Gravel composed of naturally formed particles of stone.

2.2 Materials

- .1 Gradation

To be within the limits and for the types of materials specified in Table A appended to this Section, when tested to ASTM C117 and ASTM C136, and having a smooth curve without sharp breaks when plotted on a semi-log grading chart to ASTM E11.

- .2 Production of Manufactured Fines

Manufactured fines are defined as that portion of the material passing the 5,000 sieve size which is produced by the crushing process.

In the event the manufactured fines in the total combined aggregate do not meet the requirement for the specified Asphaltic Concrete Mix, extra manufactured

finer shall be produced by screening the pitrun material so that the screened material contains no more than 5% material passing a 5,000 sieve. This screened material shall then be crushed so that 100% passes the 10,000 sieve and a minimum of 95% passes the 5,000 sieve. All material produced by this crushing process shall be placed in a separate stockpile and designated as manufactured fines.

.3 Moisture Content

As specified in specific sections.

3. EXECUTION

3.1 Processing

- .1 Process aggregate uniformly using methods that prevent contamination, segregation, and degradation.
- .2 Split and combine aggregates if required to obtain gradation requirements specified. Use approved methods and equipment. Do not blend in stockpiles.
- .3 Blending to increase percentage of crushed particles or decrease percentage of flat and elongated particles is permitted.
- .4 Wash aggregates, if required to meet specifications. Use only equipment approved by the Engineer.

3.2 Handling

- .1 Handle and transport aggregates to avoid segregation, contamination and degradation.

3.3 Stockpiling

- .1 Stockpile aggregates on site in locations indicated or designated. Do not stockpile on completed pavement surfaces where damage to pavement may result.
- .2 Stockpile aggregates in sufficient quantities to meet project schedules.
- .3 Stockpiling sites shall be level, well drained, and of adequate bearing capacity and stability to support stockpiled materials.
- .4 Except where stockpiled on acceptably stabilized areas, provide a compacted sand base not less than 300 mm in depth to prevent contamination of the aggregate or, if permitted, stockpile aggregates on ground but do not incorporate bottom 300 mm of pile into work.
- .5 Separate aggregates by substantial dividers or stockpile far enough apart to prevent intermixing.

- .6 Reject intermixed or contaminated materials. Remove and dispose of rejected materials as directed within 48 hours of rejection.
- .7 Stockpile materials in uniform layers of thickness as follows:
 - .1 Max 1 m for coarse aggregate and base course materials.
 - .2 Max 2 m for fine aggregate and subbase materials.
 - .3 Max 1.5 m for other materials.
- .8 Complete each layer over entire stockpile area before beginning next layer.
- .9 Uniformly spot-dump aggregates delivered to stockpile in trucks and build up stockpile as specified.
- .10 Coning of piles or spilling of material over edges of pile will not be permitted. Stacking conveyors will not be permitted for stockpiling road base and graded seal coat aggregates.
- .11 During winter operations prevent ice and snow from becoming mixed into stockpile or in material being removed from stockpile.

3.4 Stockpile Clean-up

- .1 Leave stockpile site in a tidy, well drained condition, free of standing surface water.
- .2 Remove any unused aggregates as directed.

SECTION 31 05 17 - TABLE A

AGGREGATE GRADATION SPECIFICATIONS

REVISED JANUARY 1998

AGGREGATE DESIGNATIONS

Designation 1: Trench Bedding Material		Designation 3: Subbase Aggregate		Designation 5: Asphaltic Concrete Pavement Aggregate				
a.	Native Fill Sand	a.	75 mm Pitrun Gravel	a.	Type 10			
b.	Clean Fill Sand	b.	150 mm Pitrun Gravel	b.	Type 12			
c.	40 mm Screened Rock	Designation 4: Base Course Aggregate		c.	Type 16			
Designation 2: Sanding Material		a.	16 mm Crushed Gravel	d.	Type 16A			
a.	5 mm Crushed Gravel	b.	20 mm Crushed Gravel	(Modified mix for Arterial Roadway toplift and overlay paving)				
b.	7.5 mm Crushed Gravel							
c.	10 mm Crushed Gravel			e.	Type 20			

Designation	Designation 1			Designation 2			Designation 3		Designation 4		Designation 5				
	a.	b.	c.	a.	b.	c.	a.	b.	a.	b.	a.	b.	c.	d.	e.
150 000								100							
125 000															
80 000							100	80 - 100							
50 000			100				80 - 100								
40 000			95 - 100												
25 000							50 - 75	50 - 80							
20 000			5 - 10						100						100
16 000									100	84 - 94			100	100	90 - 100
12 500									89 - 100			100	80 - 92	80 - 92	
10 000			0 - 5			100			78 - 94	63 - 86	100	83 - 92	70 - 84	70 - 84	56 - 84
7 500					100										
5 000	100	90 - 100	0 - 5	100	65 - 85	45 - 70	25 - 55	25 - 55	55 - 70	40 - 67	60 - 75	55 - 70	50 - 65	50 - 65	35 - 64
2 500		80 - 95			5 - 20				33 - 54		40 - 57	38 - 55	37 - 52	37 - 52	21 - 49
1 250	66 - 100	55 - 85		45 - 70		20 - 45			25 - 45	20 - 43	26 - 45	26 - 45	26 - 45	26 - 45	11 - 34
630	52 - 100			20 - 45	0 - 8				18 - 38	14 - 34	18 - 38	18 - 38	18 - 38	18 - 38	8 - 30
315	35 - 78	10 - 35		9 - 22	0 - 5	9 - 22			12 - 30	9 - 26	12 - 30	12 - 30	12 - 30	12 - 30	5 - 21
160	18 - 43			5 - 15		5 - 15			8 - 20	5 - 18	8 - 20	8 - 20	8 - 20	5 - 16	3 - 13
80	7 - 13	0 - 5		0 - 10	0 - 4	0 - 10	2 - 10	2 - 10	4 - 10	2 - 10	4 - 10	4 - 10	4 - 10	4 - 7	2 - 8

SIEVE SIZE PERCENT PASSING METRIC SIEVE (CGSB 8-GP 2mm)

1. GENERAL

This Section specifies requirements for clearing, close cut clearing, grubbing and/or clearing isolated trees.

1.1 Related Sections

- | | | |
|----|--------------------------|------------------|
| .1 | Environmental Procedures | Section 01 35 43 |
|----|--------------------------|------------------|

1.2 Definitions

- .1 Clearing consists of cutting off trees and brush vegetative growth to not more than a specified height above ground and disposing of felled trees and surface debris.
- .2 Close cut clearing consists of cutting off standing trees, brush, scrub, roots, stumps, and embedded logs, removing flush with existing grade, and disposing of fallen timber and surface debris.
- .3 Clearing isolated trees consists of cutting off to not more than a specified height above ground, of trees designated, grubbing, and disposing of felled trees and debris.
- .4 Underbrush clearing consists of removal from treed areas of undergrowth, deadwood, and trees smaller than 50 mm in diameter and disposing of all fallen timber and surface debris.
- .5 Grubbing consists of excavation and disposal of stumps and roots to not less than a specified depth below existing ground surface.

1.3 Protection

- .1 Prevent damage to fencing, trees, landscaping, natural features, bench marks, existing buildings, existing pavement, utility lines, site appurtenances, water courses, root systems of trees, which are to remain.

2. EXECUTION

2.1 Clearing

- .1 Clear trees, shrubs, uprooted stumps, and surface debris not designated to remain.
- .2 Cut off trees, brush, and scrub as indicated or as directed by the Engineer, at a height of not more than 300 mm above ground. In areas to be subsequently grubbed, height of stumps left from clearing operations to be not more than 1000 mm above existing ground.
- .3 Cut off unsound branches and cut down trees overhanging area cleared at no extra cost.

2.2 Close Cut Clearing

- .1 Cut off trees, shrubs, stumps, and other vegetation at ground level.
- .2 Cut off unsound branches and cut down trees overhanging area cleared at no extra cost.

2.3 Isolated Trees

- .1 Cut off isolated trees as indicated or as directed by the Engineer at height of not more than 300 mm above existing ground.
- .2 Grub out isolated tree stumps.

2.4 Underbrush Clearing

- .1 Clear underbrush from areas as indicated at ground level.

2.5 Grubbing

- .1 Grub out stumps and roots to not less than 200 mm below existing ground surface.

2.6 Removal and Disposal

- .1 Remove cleared and grubbed materials to disposal area designated by the Engineer.
- .2 Timber greater than 100 mm diameter, to be cut to 1200 mm lengths and stockpiled, becomes property of Owner.
- .3 Dispose of cleared and grubbed materials by burying or haul to waste transfer site as directed by the Engineer.

2.7 Finished Surface

- .1 Leave ground surface in condition suitable for site grading operations.

1. GENERAL

This Section specifies requirements for excavation, drainage excavation, borrow excavation, embankment construction, and disposal of material in accordance with this specification and conforming to lines, grades, dimensions and typical cross sections shown on plans or established by the Engineer.

1.1 Related Work

.1	Hauling and Haul Roads	Section 01 53 40
.2	Site Demolition	Section 02 41 43
.3	Clearing and Grubbing	Section 31 11 00

1.2 Definitions

- .1 Topsoil Stripping: Excavation and stockpiling of material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping, and seeding.
- .2 Rock Excavation: Rock Excavation shall include the removal from their original position of rock in solid beds or masses, and boulders or detached rock having a volume of one half cubic metre content or more ; and placing, disposing or stockpiling of the materials as directed by the Engineer.
- .3 Common Excavation: Excavation, placement, and compaction in embankments of all on-site materials whatever nature, which are not included under the definition of topsoil stripping, waste excavation, borrow excavation, or rock excavation, including dense tills, hardpan, frozen materials, and partially cemented materials which can be ripped and excavated with heavy construction equipment.
- .4 Waste Excavation: Excavation and removal from site or disposed on-site as designated by the Engineer of any material unsuitable for use in work or surplus to requirements.
- .5 Borrow Excavation: Excavation, delivery to site, placement, and compaction of suitable material obtained off-site or as shown on the drawings and used in embankment.
- .6 Transition Material: Refers to the "brown dirt" layer of material encountered between the bottom of topsoil and top of common material. Transition material to be treated as waste excavation.
- .7 Embankment: Material derived from usable excavation and placed above original ground or in stripped or undercut areas up to subgrade level.
- .8 Subgrade Elevation: Elevation immediately below pavement structure.

1.3 Requirements of Regulatory Agencies

- .1 Adhere to municipal, provincial, and national codes if blasting is required.

1.4 Traffic Provisions

- .1 Provide and maintain roadways, walkways and detours, for vehicular and pedestrian traffic as directed by the Engineer.

2. PRODUCTS**2.1 Materials**

- .1 Embankment materials require approval of the Engineer.

3. EXECUTION**3.1 Compaction Equipment**

- .1 Compaction equipment must be capable of obtaining required densities for materials on project. Equipment that does not achieve specified densities must be replaced.

3.2 Water Distributors

- .1 Apply water with equipment capable of uniform distribution and in a manner acceptable to the Engineer.

3.3 Excavating

- .1 Advise the Engineer sufficiently in advance of excavation operations for initial cross sections to be taken.
- .2 Maintain grades, cross slopes, pumps or ditches to keep excavations free of running or standing water.

3.4 Topsoil Stripping

- .1 Strip topsoil from areas and to depths indicated or directed prior to beginning of excavation and embankment work. Avoid contamination of topsoil and underlying soil. Strip transition material and dispose in designated locations.
- .2 Topsoil excavated to be stockpiled in a location as directed by the Engineer.

3.5 Rock Excavation

- .1 If during excavation, material appearing to conform to classification for rock is encountered, notify the Engineer in sufficient time to enable measurements to be

made to determine volume of rock.

- .2 Remove rock to 300 mm below sub-grade elevation indicated.
- .3 Provide effective drainage to ditches, leaving no un-drained pockets in foundation.
- .4 Scale down rock slopes and remove rock fragments which are liable to slide or roll down slopes.

3.6 Waste Excavation

- .1 Notify the Engineer whenever unsuitable materials are encountered in cut or embankment sections and remove unsuitable materials to depth and extent directed.
- .2 Dispose of waste excavation in waste site designated. If no site is designated dispose of material off-site.

3.7 Borrow Excavation

- .1 Use all suitable materials removed from excavations in embankments before taking materials from borrow areas.
- .2 Obtain from borrow areas indicated on plans additional suitable embankment material.
 - .1 The Engineer to designate location and extent of borrow areas, and allowable depth of cutting.
 - .2 Shape edges of borrow areas on slopes of 4:1 and provide drainage as directed.
 - .3 Trim and leave borrow pits in a condition to permit accurate measurement of material removed.

3.8 Blasting

- .1 Control blasting to minimize flying particles.
- .2 Treat trees damaged or scarred by flying rock with an approved tree paint.
- .3 Cut, remove, and place in a designated area trees felled or severely damaged by blast or flying rock.

3.9 Side Ditches

- .1 Construct side ditches to depths and widths indicated or directed, to permit ready flow of surface water.

- .2 Maintain and keep ditches open and free from debris until final acceptance of work.

3.10 Common Excavation

- .1 When directed, scarify or bench existing slopes in side hill or sloping sections to ensure a proper bond between new materials and existing surfaces. Obtain prior approval of method to be used.
- .2 Scarify existing ground to a depth of 150 mm and mix embankment material with existing materials to ensure a good bond.
- .3 Do not place material which is frozen or place material on frozen surfaces.
- .4 Maintain a sloped surface during construction to ensure ready run-off of surface water.
- .5 After a period of wet weather remove or scarify, dry and re-compact embankment materials softened by moisture.
- .6 Wetting or drying of fill material shall be carried out such that in-place fill has a moisture content of optimum plus or minus 2%.
- .7 With material containing less than 25% by volume of stone or rock fragments larger than 100 mm:
 - .1 Place and compact to full width in uniform layers not exceeding 150 mm loose thickness. The Engineer may authorize thicker lifts if specified compaction can be achieved.
 - .2 Compact each layer to a density of between 97% and 100% of Standard Proctor.
- .8 Where material consists principally of rock:
 - .1 Place to full width in layers of sufficient depth to contain maximum sized rocks but in no case is layer thickness to exceed 1 m.
 - .2 Individual rock fragments not exceeding 150 mm in vertical dimension to be permitted provided their vertical dimension does not exceed one-third of fill section depth.
 - .3 Carefully distribute rock material to fill voids with smaller fragments to form a compact mass.
 - .4 Fill surface voids at subgrade level with rock spalls or selected material to form an earth-tight surface.
 - .5 Boulders and rock fragments with dimensions exceeding 75 mm not to be placed within 150 mm of pavement subgrade elevation.

- .9 Report to the Engineer any damage to existing trees and/or shrubs.

3.11 Dust Control

- .1 Control dust during site grading operations by watering.

3.12 Finishing and Tolerances

- .1 Blade finished surfaces in cut and fill areas free from ruts, depressions, rocks in excess of 75 mm, and debris.
- .2 Roll finished surfaces to a tight dense condition.
- .3 Surfaces to be within 100 mm of design elevations but not uniformly high or low.

3.13 Maintenance

- .1 Maintain finished surfaces in a condition in accordance with this Section until acceptance by the Engineer.

1. GENERAL

This Section specifies requirements for excavating trenches, and backfilling for installation of pipelines, sewers, conduits, and appurtenances.

1.1 Related Work

.1	Hauling and Haul Roads	Section 01 53 40
.2	Soil Insulation	Section 31 32 41
.3	Adjustments of Manholes, Catchbasins, Hydrants and Water Valves	Section 33 05 14
.4	Water Mains	Section 33 11 17
.5	Sanitary Sewer Mains	Section 33 31 13
.6	Sewage Force Mains	Section 33 34 00
.7	Water, Sanitary and Storm Service Connections	Section 33 41 16
.8	Corrugated Steel Pipe Culverts	Section 33 42 13
.9	Storm Sewer Mains	Section 33 44 00
.10	Sub-Drainage	Section 33 46 17
.11	Catch Basin Leads	Section 33 49 16
.12	Boring or Jacking Conduits	Section 33 71 15

1.2 Definitions

- .1 Common Excavation: Excavation, placement, and compaction in embankments of all on-site materials whatever nature, which are not included under the definition of topsoil stripping, waste excavation, borrow excavation, or rock excavation; including dense tills, hardpan, frozen materials, and partially cemented materials which can be ripped and excavated with heavy construction equipment.
- .2 Rock Excavation: Rock excavation shall include the removal from their original position of rock in solid beds or masses, and boulders or detached rock having a volume of one half cubic metre content or more; and placing, disposing or stockpiling of the materials as directed by the Engineer. Rock excavation shall be paid for when the material encountered consists of mass or bedrock or a boulder of volume greater than 0.75 cubic meters. Such rock excavation is divided into two categories; (A) and (B), contingent upon its harness and difficulty experienced in excavation. It shall be the Contractor's responsibility to

demonstrate, to the Engineer's satisfaction that the material cannot be removed or that difficulty is being experienced through excavation by conventional means. In doing so, the Contractor may be required by the Engineer to seek and explore planes of weakness or layers that may ease that excavation process. Frozen material is not classified as rock.

.1 Type 'A' Rock

Type 'A' Rock refers to materials, such as fractured sandstone, shale or ledge rock, which can be removed by a backhoe for the depth of trench excavation and size of pipe being installed. For open excavation, it refers to materials, which, in the opinion of the Engineer, result in:

- Substantial delay or decrease in the normal rate of excavation using conventional equipment.
- Significant damage or wear to the excavating equipment.

.2 Type 'B' Rock

Type 'B' rock requires drilling, blasting, wedging or jackhammering to remove, as determined by the Engineer.

.3 Bedding Material: Materials placed at the bottom of the trench beneath and up to the springline of the pipe, as specified and approved by the Engineer.

.4 Pipe Foundation: Subgrade material immediately below bedding.

.5 Initial Backfill: Material placed within the trench, above the spring line of the pipe to 300 mm above the crown of the pipe.

.6 Bedding Class: Pipes to be bedded to one of following classes, as specified on drawings:

Class A

.1 Concrete Cradle: Pipe is bedded in concrete up to $\frac{1}{4}$ outside pipe diameter, for a minimum width of pipe diameter plus 200 mm. Above cradle, granular backfill is placed and compacted to 300 mm above pipe.

.2 Concrete Arch: Pipe is bedded in carefully compacted granular bedding to spring line. Top half of pipe is covered with concrete to minimum depth of $\frac{1}{4}$ of inside diameter of pipe. Arch width is to be a minimum of pipe outside diameter plus 200 mm.

Class B

.1 Shaped Subgrade: Bottom of undisturbed excavation is shaped to conform to pipe shape and uniformly support pipe. Pipe is bedded on a 50 mm levelling course of sand. Granular bedding is placed and compacted up to the spring line of the pipe. Pipe is backfilled with

imported granular or hand-placed native backfill and compacted to 300 mm above crown of pipe.

- .2 Granular Bedding: Pipe is bedded on compacted granular material placed on flat trench bottom, depth of bedding to be:

<u>Pipe Diameter (mm)</u>	<u>Bedding Depth (mm)</u>
675 and smaller	75
750 to 1500	100
1650 and larger	150

Granular bedding is placed and compacted up to the spring line of the pipe. Pipe to be backfilled and compacted with imported granular or hand-placed native backfill to 300 mm above crown of pipe.

- .7 Fill Concrete: Controlled density, low strength concrete used as trench backfill material where specified by the Engineer.

1.3 Protection

.1 Existing Buried Utilities

- .1 Size, depth, and location of existing utilities shown on Drawings are for guidance only; completeness and accuracy are not guaranteed.
- .2 Prior to commencing any excavation work, notify applicable utility authorities, and establish location and state of use of buried services. Clearly mark such locations to prevent disturbance during work.
- .3 Maintain and protect from damage, water, sewer, gas, electric, or other utilities encountered.
- .4 Obtain written authorization of owner of utility and the Engineer before moving or otherwise disturbing utility.

.2 Existing Surface Features

- .1 Protect existing buildings, trees and other plants, lawns, fencing, service poles, wires or paving located within right of way or adjoining properties from damage while work is in progress. Repair to the Engineer's satisfaction any damage which may occur.
- .2 Where excavation necessitates root or branch cutting, do so only under direct control of the Engineer.

.3 Shoring and Bracing

- .1 Whenever shoring, sheeting, timbering and bracing of excavations is required, engage services of a professional engineer to design and assume

responsibility for adequacy of shoring and bracing. The professional engineer is to be registered and licensed to practice in Alberta.

- .2 When requested by the Engineer, submit for review Drawings and calculations signed and stamped by the professional engineer responsible for their preparation.
- .3 Close sheeting, when required, to be designed and constructed to prevent adjacent soil or water from entering excavation.
- .4 Access

Maintain unobstructed access to fire and police appurtenances, telephone, electric, water, sewer, gas or other public utilities and private properties.
- .5 Flooding

Protect open excavation against flooding and damage from surface water run-off.

1.4 Safety Requirements

- .1 Adhere to Municipal and Provincial requirements relating to safety of trenching work, including shoring and bracing as required.
- .2 Adhere to all crossing permit (railway, pipeline, telecommunications duct, etc.) requirements.
- .3 Provide barricades, flares, etc. to adequately denote area of excavation adjacent to roadways. Traffic control to be in accordance with Section 01 35 14 – Traffic Control.

2. PRODUCTS

2.1 Bedding and Initial Backfill Materials

- .1 Initial backfill and bedding materials shall consist of the following:
 - .1 native fill sand,
 - .2 40 mm screened rock,
 - .3 screened pea gravel,
 - .4 16 mm crushed gravel, or
 - .5 native hand placed material may be used as initial backfill.
Gradation to be in accordance with Section 31 05 17 - Aggregate Materials.
- .2 Material to be used as specified by the Engineer or as shown on Drawings.

- .3 Concrete required for Class A bedding, grades, supports, encasement as specified in Section 03 05 13 - Table A Concrete Design Requirements.
- .4 Native backfill to be approved material selected from trench excavation or other source, unfrozen and free from deleterious material, and with moisture content within 3% of optimum.

2.2 Roadway Trench Backfill Material

- .1 To minimize fill settlement under self weight, excavated soil with a water content exceeding the plastic limit of the soil by more than 10% should not be used as fill unless the moisture content is lowered.
- .2 Wet fill material should be dried or blended with drier material prior to use as a trench backfill. If this is not practical, the wet material should be wasted or used in landscape areas and berms where bearing capacity is not required.
- .3 Suitable replacement soils would include imported clay with moisture content within 3% of its optimum moisture content for compaction, or imported sand materials suitable for compaction.

3. EXECUTION

3.1 Site Preparation

- .1 Remove trees, shrubs, vegetation, fences, and other obstructions, ice and snow, from surfaces to be excavated within limits indicated.
- .2 Strip top soil from within limits of excavation and stockpile as directed, for re-spreading after backfilling. Refer to Section 01 35 03 - Environmental Procedures

3.2 Dewatering

- .1 Keep excavations dry while work is in progress.
- .2 Dispose of water in a manner not detrimental to public health, environment, public and private property, or any portion of work completed or under construction.

3.3 Excavation

- .1 Excavate to lines, grades, elevations and dimensions indicated on Drawings. Ground profiles are approximate only. Precise line and grade will be set out by the Consulting Engineer. Allow the Consulting Engineer two working days advance notice to set out line and grade.
- .2 Cut pavement or sidewalk neatly along limits of proposed excavation.

- .3 Where edge of existing pavement is damaged as a result of trench excavation in shoulder, a minimum 300 mm width to be cut neatly and continuously and reinstated in accordance with Clause 3.9 of this Section. Work included under restoration.
- .4 Notify the Engineer when soil at proposed elevation of trench bottom appears unsuitable for foundation of installation. Remove unsuitable material and replace with approved 40 mm screened rock bedding as shown in Drawings 50.10.01 and 50.10.02 under Division 50.
- .5 Notify the Engineer if new construction conflicts with discovered obstruction. Allow the Engineer sufficient time to consider alternative alignment to avoid conflict with obstruction. Modify alignment as directed by the Engineer.
- .6 Unless otherwise authorized by the Engineer, do not excavate more than 30 m of trench in advance of installation operations and do not leave open more than 15 m of open trench at end of days operation.
- .7 Stockpile suitable excavated materials required for trench backfill in approved location.
- .8 Dispose of surplus and unsuitable material at a waste site designated by the Engineer or a site located by the Contractor, and approved by the Engineer.
- .9 Do not obstruct flow of surface drainage or natural watercourses.
- .10 Excavated rock to a level 150 mm below the barrel of pipe.

3.4 Trench Bottom Preparation

- .1 Where required due to removal of unsuitable material or unauthorized over-excavation, bring bottom of excavation to design grade with approved material.

3.5 Pipe Bedding and Initial Backfill

- .1 Concrete Bedding and Encasement
 - .1 Do concrete work to Section 03 30 20 – Cast-In-Place Concrete. Place concrete to details indicated or directed.
 - .2 Pipe may be positioned on concrete blocks to facilitate placing of concrete. When necessary rigidly anchor or weight pipe to prevent flotation when concrete is placed.
 - .3 Do not backfill over concrete within 24 hours after placing.

.2 Granular Bedding

- .1 Place granular bedding materials to Class B unless otherwise indicated on drawings.
- .2 Shape bed true to grade to provide continuous uniform bearing surface for pipe exterior. Do not use blocks when bedding pipe.
- .3 Shape transverse depressions in bedding as required making joints.
- .4 Compact full width of bed to a density of 100% Standard Proctor.
- .5 Place layers simultaneously on both sides of installed work to equalize loading.
- .6 Place material by hand under, around, and over pipe until 300 mm of cover is provided. Dumping material directly on pipe will not be permitted.

3.6 Backfilling

- .1 Do not place backfill in freezing weather without written permission of the Engineer.
- .2 Shoring, sheeting, and bracing
 - .1 Unless otherwise indicated, or directed by the Engineer, remove sheeting and shoring from trench during backfilling operations.
 - .2 Do not remove bracing until backfilling has reached level of bracing.
 - .3 Pull sheeting in 150 mm increments until clear of installations, simultaneously placing and compacting backfill to fill voids left by pulled sheeting.
 - .4 Pull sheeting thereafter in increments that will ensure backfill is maintained at an elevation at least 450 mm above toe of sheeting.
 - .5 When sheeting is to remain in place, cut off tops at elevations indicated or directed.
- .3 Place backfill material in uniform layers not exceeding 300 mm in compacted thickness up to subgrade elevation or top of trench. Compact each layer before placing succeeding layer.
- .4 Compact native backfill materials to a minimum density of 97% Standard Proctor. In lane, utility lot, and park areas, the Engineer may reduce the compaction requirement to 100% of a one-point proctor test if, in his opinion, it is not feasible to achieve the specified density. The one-point proctor density is to be measured at the in situ soil moisture content. In street areas, drying and/or mixing of

backfill soil may be necessary to achieve the 97% maximum Standard Proctor density as specified.

- .5 Compact imported granular backfill material to a minimum density of 97% Standard Proctor.
- .6 Compact using approved mechanical tamping devices, or by hand tamping to achieve specified compaction.

3.7 Trench Backfill and Compaction for Shallow Utilities

- .1 This Clause shall apply to the installation of power, gas, telephone, and cable television in new development areas.
- .2 Road and lane crossings, or other areas to be hard surfaced, are to be backfilled as outlined in Clause 3.6 of this Section.
- .3 Trenches in landscaped areas; such as boulevards, rear yard easements, front yard easements, side yard easement, parks, etc.; shall be backfilled and compacted as follows:
 - .1 Place initial 750 mm \pm lift of native backfill material and compact to 95% Standard Proctor Density.
 - .2 Place remainder of backfill material and compact to 95% Standard Proctor Density.
 - .3 Following compaction of final lift, fill depression with native material. Level surrounding area.

3.8 Fill Concrete Backfill

- .1 Place bedding and initial backfill material as per Clause 3.6.
- .2 Backfill with fill concrete to level directed by the Engineer.
- .3 Vibrate to ensure all voids are filled.
- .4 Allow 48 hours curing time prior to working over top of fill concrete.

3.9 Restoration

- .1 Replace topsoil as directed by the Engineer.
- .2 Restore travelled areas to the pavement or concrete structure shown on the contract drawings.
- .3 Clean and reinstate areas affected by work as directed.
- .4 Do cleaning to Section 01 74 11 Cleaning.

1. GENERAL

This Section specifies requirements for road excavation, road drainage excavation, borrow excavation, embankment construction, and disposal of material in accordance with specification and conforming to lines, grades, dimensions, and typical cross sections shown on plans or established by the Engineer.

1.1 Related Work

.1	Hauling and Haul Roads	Section 01 53 40
.2	Site Demolition	Section 02 41 43
.3	Aggregate Materials	Section 31 05 17
.4	Clearing and Grubbing	Section 31 11 00
.5	Site Grading	Section 31 22 30
.6	Geo-grid Soil Reinforcement	Section 31 32 20
.7	Soil Insulation	Section 31 32 41
.8	Sub-Drainage	Section 33 46 17

1.2 Definitions

- .1 Topsoil Stripping: Excavation and stockpiling of material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping, and seeding.
- .2 Common Excavation: Excavation, placement, and compaction in embankments of all on-site material whatever nature, which are not included under the definition of topsoil stripping, waste excavation, borrow excavation or rock excavation, including dense tills, hardpan, frozen materials, and partially cemented materials which can be ripped and excavated with heavy construction equipment.
- .3 Waste Excavation: Excavation and removal from site or disposed on-site as designated by the Engineer of any material unsuitable for use in work or surplus to requirements.
- .4 Rock Excavation: Rock Excavation shall include the removal from their original position of rock in solid beds or masses, and boulders or detached rock having a volume of one half cubic metre content or more; and placing, disposing or stockpiling of the materials as directed by the Consultant. Rock excavation shall be paid for when the material encountered consists of mass or bedrock or a boulder of volume greater than 0.75 cubic meters. Such rock excavation is divided into two categories; (A) and (B), contingent upon its hardness and difficulty experienced in excavation. It shall be the Contractor's responsibility to demonstrate, to the Engineer's satisfaction that the material cannot be removed or

that difficulty is being experienced through excavation by conventional means. In doing so, the Contractor may be required by the Engineer to seek and explore planes of weakness or layers that may ease the excavation process. Frozen material is not classified as rock.

.1 Type 'A' Rock

Type 'A' Rock refers to materials, such as fractured sandstone, shale or ledge rock, which can be removed by a backhoe for the depth of excavation. For open excavation, it refers to materials which, in the opinion of the Engineer, result in:

- Substantial delay or decrease in the normal rate of excavation using conventional equipment.
- Significant damage or wear to the excavating equipment.

.2 Type 'B' Rock

Type 'B' Rock requires drilling, blasting, wedging or jack hammering to remove, as determined by the Engineer.

- .5 Borrow Excavation: Excavation, delivery to site, placement and compaction of suitable material obtained off-site and used in embankment.
- .6 Unsuitable Subgrade: Material at design subgrade level not suitable for pavement structure subgrade, shall be removed as directed by the Engineer and replaced with suitable material.
- .7 Embankment: Material placed above original ground or in stripped or undercut areas up to subgrade elevation.
- .8 Pavement Structure: Combination of layers of unbound or stabilized granular subbase, base, and asphalt or concrete surfacing.
- .9 Subgrade Elevation: Elevation immediately below pavement structure.
- .10 Subgrade Preparation: Shaping, scarifying, conditioning, blading, and compacting of subgrade.

1.3 Requirements of Regulatory Agencies

- .1 Adhere to municipal, provincial, and national codes if blasting is required.

1.4 Traffic Provisions

- .1 Provide and maintain roadways, walkways, and detours, for vehicular and pedestrian traffic as directed by the Engineer.
- .2 Refer to Section 01 58 99 - Temporary Construction Signing.

1.5 Protection

- .1 Existing Surface Features
 - .1 Protect existing buildings, trees and other plants, lawns, fencing, service poles, wires, or paving located within right of way or adjoining properties from damage while work is in progress. Repair to the Engineer's satisfaction any damage, which may occur.
- .2 Trees and Shrubs
 - .1 Where excavation necessitates root or branch cutting do so only under direct control of the Engineer.

1.6 Safety Requirements

- .1 Adhere to Municipal and Provincial requirements relating to safety of trenching work, including shoring and bracing as required.
- .2 Adhere to all crossing permit (railway, pipeline, telecommunications duct, etc.) requirements.
- .3 Provide barricades, flares, etc. to adequately denote area of excavation adjacent to roadways.

2. PRODUCTS**2.1 Materials**

- .1 Embankment Material
 - .1 Embankment materials to be approved by the Engineer.
- .2 Subgrade Replacement Material
 - .1 Unsuitable subgrade replacement aggregates shall consist of the following:
 - .1 native fill sand
 - .2 75 mm or 150 mm pitrun gravel
 - .3 other material approved by the Engineer
- .3 Gradation to be in accordance with Section 31 05 17 - Aggregates Materials.
- .4 Material to be used as specified by the Engineer, or as shown on the Drawings.

3. EXECUTION

3.1 Compaction Equipment

- .1 Compaction equipment must be capable of obtaining required densities for materials on project. Equipment that does not achieve specified densities must be replaced.

3.2 Water Distributors

- .1 Apply water with equipment capable of uniform distribution and in a manner acceptable to the Engineer.

3.3 Excavating

- .1 Advise the Engineer sufficiently in advance of excavation operations for initial cross sections to be taken.
- .2 Maintain crowns, cross slopes, pumps, or ditches to keep excavations free of running or standing water.

3.4 Topsoil Stripping

- .1 Strip topsoil from areas and to depths indicated or directed prior to beginning of excavation and embankment work. Avoid contamination of topsoil and underlying soil.
- .2 Topsoil excavated to be stockpiled in a location as directed by the Engineer.

3.5 Rock Excavation

- .1 If, during excavation, material appearing to conform to classification for rock is encountered, notify the Engineer in sufficient time to enable measurements to be made to determine volume of rock.
- .2 Remove rock to 300 mm below subgrade elevation indicated.
- .3 Provide effective drainage to ditches, leaving no un-drained pockets in foundation.
- .4 Scale down rock slopes and remove rock fragments, which are liable to slide or roll down slopes.

3.6 Common Excavation

- .1 Material designated as common excavation to be excavated, hauled, and compacted in designated fill areas on site.

3.7 Waste Excavation

- .1 Notify the Engineer whenever unsuitable materials are encountered in cut or embankment sections and remove unsuitable materials to depth and extent directed.
- .2 Dispose of waste excavation at designated waste site. If no waste site is designated dispose of material off-site in an area located by Contractor and approved by the Engineer.

3.8 Borrow Excavation

- .1 Use all suitable materials removed from excavations in embankments before taking material from borrow areas.
- .2 Obtain from borrow areas located on project property additional suitable embankment material.
 - .1 The Engineer to designate location and extent of borrow areas, and allowable depth of cutting.
 - .2 Shape edges of borrow areas on slopes of 4:1 and provide drainage as directed.
- .3 Trim and leave borrow pits in a condition to permit accurate measurement of material removed.

3.9 Unsuitable Subgrade

- .1 Notify the Engineer when unsuitable materials are encountered at design subgrade elevation. Sub cut and dispose of unsuitable material and replace with a compacted approved material.
- .2 When subgrade after sub-cutting is still unsuitable, geotextile may be installed at direction of the Engineer.
- .3 Dispose of unsuitable subgrade materials at designated waste site. If no waste site is designated, dispose of material off site in an area located by Contractor and approved by the Engineer. Costs associated with disposal to be included in unit rate for waste excavation.

3.10 Blasting

- .1 Control blasting to minimize flying particles.
- .2 Treat trees damaged or scarred by flying rock.
- .3 Cut, remove, and place in a designated area trees felled or severely damaged by blast of flying rock.

3.11 Side Ditches

- .1 Construct side ditches to depths and widths indicated or directed, to permit ready flow of surface water.
- .2 Maintain and keep ditches open and free from debris until final acceptance of work.

3.12 Embankments

- .1 When directed, scarify, or bench existing slopes in side hill or sloping sections to ensure a proper bond between new materials and existing surfaces. Obtain prior approval of method to be used.
- .2 Scarify existing ground to a depth of 150 mm and mix embankment material with existing materials to ensure a good bond.
- .3 Do not place material which is frozen, or place material on frozen surfaces.
- .4 Maintain a crowned surface during construction to ensure ready run-off of surface water.
- .5 After a period of wet weather, remove or scarify, dry, and re-compact embankment materials softened by moisture.
- .6 Wetting or drying of fill material shall be carried out such that in-place fill has a moisture content of optimum plus or minus 2%.
- .7 With material containing less than 25% by volume of stone or rock fragments larger than 100 mm:
 - .1 Place and compact to full width in uniform layers not exceeding 150 mm loose thickness. The Engineer may authorize thicker lifts if specified compaction can be achieved.
 - .2 Compact each layer to a minimum density of 97% Standard Proctor except last 300 mm up to subgrade elevation. Compact last 300 mm to a minimum density of 100% Standard Proctor.
- .8 Where material consists principally of rock:
 - .1 Place to full width in layers of sufficient depth to contain maximum sized rocks but in no case is layer thickness to exceed 1 m.
 - .2 Individual rock fragments not exceeding 150 mm in vertical dimension to be permitted provided their vertical dimension does not exceed one-third of fill section depth.
 - .3 Carefully distribute rock material to fill voids with smaller fragments to form a compact mass.

- .4 Fill surface voids at subgrade level with rock spalls or selected material to form an earth-tight surface.
- .5 Boulders and rock fragments with dimensions exceeding 75 mm not to be placed within 150 mm of pavement subgrade elevation.
- .9 Construct and compact embankments to an elevation at least 50 mm above design elevations and cut back to design elevations.

3.13 Subgrade Preparation

- .1 Subgrade shall be scarified to a depth of 150 mm and scarified material moved to one side.
- .2 Exposed surface shall be compacted to 100% Standard Proctor Density.
- .3 Windrowed material shall then be replaced and compacted to 100% Standard Proctor Density at optimum moisture content.
- .4 Prepared areas should be compacted to a level slightly above the final subgrade elevation then cut back to final grade.
- .5 Finished surface shall conform to lines, grades, and cross sections indicated on Drawings, within a tolerance of 13 mm.

3.14 Proof Rolling

- .1 For proof rolling, use a roller of 45400 kg gross mass with four pneumatic tires each carrying 11350 kg and inflated to 620 kPa. Four tires arranged abreast with centre to centre spacing of 915 mm maximum.
- .2 The Engineer may authorize use of other acceptable proof rolling equipment. Alternately, use a single axle dual wheeled truck with a load of 9,100 kg on the rear axle with tires inflated to a minimum of 275 kPa.
- .3 Proof roll at level in subgrade indicated. If alternative proof rolling equipment is authorized, the Engineer will determine level of proof rolling.
- .4 Make sufficient passes with the vehicle to ensure the surface is subjected to a tire load within 500 mm of any point.
- .5 Where proof rolling reveals areas of defective subgrade, the Engineer shall determine limits of unsuitable subgrade excavation, and shall specify replacement material.

3.15 Maintenance

- .1 Maintain road surfaces until next course of material is placed, or until project, or that portion thereof, is accepted.

1. GENERAL

This Section specifies requirements for re-compacting and reshaping of existing subgrade to lines, grades, and typical cross sections indicated or as established by the Engineer.

1.1 Related Work

- | | | |
|----|-----------------------------------|------------------|
| .1 | Roadway Embankment and Compaction | Section 31 24 13 |
|----|-----------------------------------|------------------|

1.2 Measurement Procedures

- .1 Reshaping subgrade will be measured in square metres of roadway subgrade reshaped.
- .2 Additional subgrade material will be measured under Section 31 24 13 – Roadway Embankment and Compaction.

1.3 Definitions

- .1 Reshaping subgrade: scarifying, pulverizing, blading, reshaping, and re-compacting existing subgrade surface.

2. EXECUTION

2.1 Scarifying and Reshaping

- .1 Scarify subgrade to full width as indicated or as directed by the Engineer, and to a minimum depth of 150 mm.
- .2 Pulverize and break down scarified material to 10 mm maximum soil clod size, except that stones larger than this size may be left intact as directed by the Engineer.
- .3 Blade and trim pulverized material to elevation and cross section dimensions as indicated or as directed by the Engineer.
- .4 Where deficiency of material exists, add and blend additional subgrade material as directed by the Engineer.
- .5 Reuse excess waste material in areas of material deficiency.

2.2 Compacting

- .1 Compact to density not less than 100% Standard Proctor Density in accordance with ASTM D698.
- .2 Shape and roll alternatively to obtain smooth, even, and uniformly compacted subgrade surface.

- .3 Apply water as necessary during compaction to obtain specified density.
- .4 If material is excessively moist, aerate by scarifying with suitable equipment until moisture content is reduced to optimum value for compaction in accordance with ASTM D698.

2.3 Site Tolerances

- .1 Reshaped compacted surface to be within plus or minus 10 mm of elevation as indicated.

2.4 Protection

- .1 Maintain reshaped surface in condition conforming to this Section until succeeding material is applied or until accepted by the Engineer.

1. GENERAL

This Section specifies requirements for supply and installation of geo-synthetic material (referred to as geo-grid) produced in an open grid configuration to be used primarily for reinforcement in slope stabilization or secondarily as separation of and stabilization for road base materials.

1.1 Related Work

.1	Roadway Embankment and Compaction	Section 31 24 13
.2	Gabions	Section 31 36 10
.3	Rip-Rap	Section 31 37 10
.4	Sub-Drainage	Section 33 46 17

1.2 Mill Certificates

- .1 At least one week prior to start of Work, furnish the Engineer with copies of mill test data and a certificate that geo-grid material delivered to the job site meets the requirements of this Section.

1.3 Approval

- .1 Obtain written approval of the Engineer for geo-grid material before installation of material in the Work.

1.4 Measurement of Payment

- .1 Geo-grid will be measured in square metres regardless of application. No allowance will be made for overlaps.

2. PRODUCTS

2.1 Material

- .1 Synthetic Polymer Fabric:
 - .1 To be rot-proof.
 - .2 Treated to be unaffected by naturally encountered chemicals, alkalis and acids.
 - .3 Treated to be unaffected by insects or rodents.
 - .4 Free of striations, roughness, pinholes, blisters, un-dispersed raw materials or any sign of contamination by foreign matter.

- .5 Treated with inhibitors to resist deterioration by ultra-violet light and heat exposure.
- .2 Type
 - .1 Uniaxial Geo-grid to be used for slope stabilization.
 - .2 Biaxial Geo-grid to be used for road base reinforcement.
- .3 Physical Properties: Uniaxial Geo-grid
 - .1 Tensile strength @ 5% strain to be greater than 24 kN/m and meet ASTM D6637.
 - .2 Rigid junction strength to be 2 times greater then tensile strength and meet GG1-GG2.
 - .3 Tensile creep strength to be greater than 30 kN/m and meet ASTM D5262.
 - .4 Long term design strength for sand, silt an dclay to be greater than 12 kN/m and meet GG1-GG4.
- .4 PVC Coating (where specified): The protective PVC plastic coating shall be suitable to resist deleterious effects of natural weather exposure, immersion in salt water, and shall not show any material difference in its initial compound properties. The coating shall be 0.48 mm thick.

3. EXECUTION

3.1 Installation

- .1 Place geo-grid by unrolling on to graded surface, stretch taut and retain in position.
- .2 Protect geo-grid from displacement or damage until and during placement of overlaid material layers.
- .3 Place geo-grid on sloping surfaces in one continuous length from toe of slope to upper extent of fabric.
- .4 Overlap each successive strip of geo-grid 500 mm over previously laid strip.
- .5 Seams to be connected as per manufacturers recommendations.
- .6 Protect geo-grid material from displacement and damage during placement of granular sub-base and/or granular base material.
- .7 After installation, cover with granular material within four hours of placement.

- .8 Remove and replace fabric damaged or deteriorated as directed by the Engineer.

3.2 Protection

- .1 Do not permit passage of any vehicle directly on geo-grid at any time.

1. GENERAL

This Section specifies requirements for supply and installation of geo-synthetic material (referred to as geotextile) produced in at woven / non-woven membrane configuration used primarily for separation of differing granular materials or water / soil filtration within a road structure or secondarily as reinforcement of a granular road structure.

1.1 Related Work

.1	Aggregate Materials	Section 31 05 17
.2	Roadway Embankment and Compaction	Section 31 24 13
.3	Granular Sub-Base	Section 32 11 19

1.2 Mill Certificates

- .1 At least one week prior to start of Work, furnish the Engineer with copies of mill test data and a certificate that the geotextile material delivered to the job site meets the requirements of this Section.

1.3 Approval

- .1 Obtain written approval of the Engineer for geotextile material before installation of material in the Work.

2. PRODUCTS

2.1 Material

- .1 Synthetic Polymer Fabric
 - .1 To be rot-proof.
 - .2 Treated to be unaffected by naturally encountered chemicals, alkalis and acids.
 - .3 Treated to be unaffected by insects or rodents.
 - .4 Free of striations, roughness, pinholes, blisters, un-dispersed raw materials or any sign of contamination by foreign matter.
 - .5 Treated with inhibitors to resist deterioration by ultra-violet light and heat exposure.
- .2 Type
 - .1 Non-woven needle-punched geotextile to be used in filtration applications.

- .2 Woven Geotextile to be used for granular separation and stabilization applications.
- .3 Physical Properties
 - .1 Tensile strength to be greater then 600N and meet ASTM D4632.
 - .2 Elongation to be equal or greater then 15% and meet ASTM D4632.
 - .3 Puncture strength to be greater then 280N and meet ASTM D4833.
 - .4 Mullen Burst to be greater then 2200kPa and meet ASTM D3786.
 - .5 Trapezoidal Tear to be greater then 24N and meet ASTM D4533.
 - .6 Flow Rate to be 160 l/m/m² and meet ASTM D4491.
 - .7 Permittivity to be 0.05 sec⁻¹ and meet ASTM D4491.
 - .8 Apparent Opening Size (AOS) to be less then 0.600 mm and meet ASTM D4751.
 - .9 UV Resistance to minimally be 70% @ 500 hours and meet ASTM D4355.
- .4 Seams
 - .1 Sewn to Manufacturers specifications. Threading material to equal or exceed specifications of fabric.
 - .2 Woven geotextile to be used for granular separation and stabilization applications.

3. EXECUTION

3.1 Installation

- .1 Place geotextile by rolling on to prepared surface, stretch taut and retain in position.
- .2 Place geotextile smooth and free of tension stress, folds, wrinkles and creases.
- .3 Protect geotextile from displacement or damage until and during placement of overlaid material layers.
- .4 Place geotextile of sloping surfaces in one continuous length from toe of slope to upper extent of roll.
- .5 Overlap each successive strip of geotextile minimally 500 mm at seams or join

successive strips by sewing, as recommended by manufacturer.

- .6 Protect geotextile material from displacement and damage during placement of granular sub-base and/or granular base material.
- .7 After installation, cover with granular material within four hours of placement.
- .8 Remove and replace fabric damaged or deteriorated as directed by the Engineer.

3.2 Protection

- .1 Do not permit passage of any vehicle directly on geotextile at any time.

1. GENERAL

This Section specifies requirements for supplying and installing soil insulation.

1.1 Related Work

- | | | |
|----|-----------------------------------|------------------|
| .1 | Trench Excavation and Backfilling | Section 31 23 16 |
| .2 | Roadway Embankment and Compaction | Section 31 24 13 |

1.2 Delivery and Storage

- | | |
|----|--|
| .1 | During delivery and storage, protect insulation from direct sunlight, physical damage and incompatible chemicals (solvents, petroleum products, etc.). On the job site, cover temporarily stored insulation with a light coloured tarpaulin. Insulation must not be exposed to flame or other ignition source. |
|----|--|

2. PRODUCTS

2.2 Material

- | | |
|----|--|
| .1 | Styrofoam High Load 40 as manufactured by Dow Chemical Canada Inc., or approved equal. |
|----|--|

3. EXECUTION

3.2 Utility Main Insulation

- | | |
|----|---|
| .1 | Complete trench excavation and bedding material placement in accordance with Section 31 23 16 – Trench Excavation and Backfilling. Increase trench width to accommodate required insulation width and/or depth. |
| .2 | Install utility pipeline and bedding material as specified in section 31 23 16 - Trench Excavation and Backfilling. |
| .3 | Install soil insulation in accordance with manufacturer's instructions and as shown on Drawing 50.10.03, included as part of Division 50. |
| .4 | Backfill and compact trench in accordance with Section 31 23 16 – Trench Excavation and Backfilling. |

3.3 Roadway Insulation

- | | |
|----|---|
| .1 | Complete roadway excavation and subgrade preparation in accordance with Section 31 24 13 – Roadway Embankment and Compaction. |
| .2 | Place soil insulation as shown on the Construction Drawings. To prevent wind blow-off, pin in place with wooden skewers or weigh down with granular material. |

- .3 Place and compact first lift of granular material carefully to prevent damage or displacement.
- .4 Place subsequent lifts of granular material and asphalt as specified.

1.3 Protection

- .1 Do not permit passage of any vehicle directly on soil insulation at any time.

1. GENERAL

This Section specifies requirements for supply and installation of baskets and/or mats fabricated from wire mesh or geo-grids filled with stone. A gabion structure consists of a number of baskets or mats connected together forming a monolithic structure.

1.1 Related Work

- | | | |
|----|-----------------------------|------------------|
| .1 | Geo-grid Soil Reinforcement | Section 31 32 20 |
|----|-----------------------------|------------------|

1.2 References

- | | |
|----|---|
| .1 | ANSI/ASTM D 638 M, Test Method for Tensile Properties of Plastic (metric). |
| .2 | ASTM A 313, Specification for Chromium-Nickel Stainless and Heat Resisting Steel Spring Wire. |
| .3 | ASTM A 764, Specification for Steel Wire, Carbon, Drawn, Galvanized, and Galvanized at Size for Mechanical Springs. |
| .4 | CAN/CSA-G164, Hot Dip Galvanizing of Irregularly Shaped Articles. |

2. PRODUCTS

2.1 Materials

- | | |
|----|---|
| .1 | Gabion Baskets |
| .1 | Factory fabricated so that sides, ends, lid, and internal diaphragms readily assemble at site into rectangular baskets of sizes as indicated. |
| .2 | Single unit construction or with joints having strength and flexibility equal to that of mesh. |
| .3 | When length exceeds horizontal width, provide diaphragms of same mesh as gabion walls to divide basket into equal cells of length not in excess of horizontal width. |
| .2 | Wire Mesh Gabions |
| .1 | Wire mesh to be uniform hexagonal pattern wire woven in triple twist pattern with openings of approximately 80 mm x 100 mm and fabricated to be non-ravelling. Perimeter edges of mesh to be securely selvage so that joints formed by connecting selvages are as strong as body of mesh. |
| .2 | Wire to have the following dimensions: |
| .1 | Mesh: 3.0 mm diameter. |

- .2 Selvedge's: 3.8 mm diameter.
 - .3 Binding: 2.0 mm diameter.
 - .3 Wire is to be hot dip galvanized with minimum coverage of 260 g/m² to CSA G164.
 - .4 Interlocking wire fasteners are to be galvanized steel to ASTM A 764, finish 1, class 1, type 3.
- .3 Geo-grid Gabions
 - .1 Geo-grid mesh to be rigid type, uniform, square pattern, non-corrosive, high density polyethylene with inhibitors added to resist deterioration by ultra-violet and heat exposure. Geo-grid openings to be 50 mm x 50 mm.
 - .2 Geo-grid to have the following mechanical properties:
 - .1 Tensile modulus at 2% elongation: to ANSI/ASTM D638M, modified to manufacturer's recommendations, minimum 290 kN/m.
 - .2 Junction strength: to ANSI/ASTM D638M, modified to manufacturer's recommendations, minimum 90% of single rib strength.
- .4 Gabion Mats
 - .1 Factory fabricated so that sides, ends, lid, and internal diaphragms readily assemble at site into rectangular mats.
 - .2 Single unit construction or with joints having strength and flexibility equal to that of mesh.
 - .3 When length exceeds horizontal width, provide diaphragms of same mesh as gabion walls to divide mat into equal cells not in excess of 1 m x 3 m.
- .5 Wire Mesh Gabion Mats
 - .1 Wire mesh to be uniform hexagonal pattern wire woven in triple twist pattern with openings of approximately 80 mm x 100 mm and fabricated to be non-raveling. Perimeter edges of mesh to be securely selvedge so that joints formed by connecting selvedges are as strong as body of mesh.
 - .2 Wire to have the following dimensions:
 - .1 Mesh: 2.20 mm diameter.
 - .2 Selvedges: 2.65 mm diameter.

- .3 Binding: 2.20 mm diameter.
- .3 Wire is to be hot dip galvanized with minimum coverage of 260 g/m² to CSA G164.
- .4 Interlocking wire fasteners are to be galvanized steel to ASTM A 764, finish 1, class 1, type 3, stainless steel to ASTM A 313.
- .6 Geo-grid Gabion Mats
 - .1 Geo-grid mesh to be rigid type, uniform, square pattern, non-corrosive, high density polyethylene with inhibitors added to resist deterioration by ultra-violet and heat exposure. Geo-grid openings to be 50 mm x 50 mm.
 - .2 Geo-grid to have the following mechanical properties:
 - .1 Tensile modulus at 2% elongation: to ANSI/ASTM D638M, modified to manufacturer's recommendations, minimum 290 kN/m.
 - .2 Junction strength: to ANSI/ASTM D 638M, modified to manufacturer's recommendations, minimum 90% of single rib strength.
- .7 Stone Fill
 - .1 Hard, durable, abrasion resistant such that it will not disintegrate from action of wetting and drying, wave action, freezing and thawing cycles.
 - .2 Minimum 100 mm to maximum 200 mm dimension for individual stones.
- .8 Geotextile filter: to Section 31 32 21 - Geotextiles.

3. EXECUTION

3.1 Installation

- .1 Install gabions and geotextiles to lines and grades as indicated. Follow manufacturer's instructions in assembling baskets and mats.
- .2 Excavate for and backfill behind gabions in accordance with Section 31 23 16 - Trench Excavation and Backfilling.

3.2 Placing Gabions

- .1 Wherever possible, place baskets and mats in position prior to filling with stones.
- .2 Join adjacent baskets and mats together at corners as recommended by manufacturer, so that joints are as strong as mesh.

3.3 Filling Baskets and Mats

- .1 Tension geo-grid gabions according to manufacturer's instructions before filling with stone. Do not release wall tension until sufficient stone fill has been placed to prevent wall slackening.
- .2 On exposed faces of gabions, place stones by hand with flattest surfaces bearing against face mesh to produce satisfactory alignment and appearance.
- .3 For wire mesh gabions, fill gabion cells in lifts not exceeding 300 mm and connect opposite walls with two tie wires after each lift.
- .4 For geo-grid gabions, fill cells in lifts not exceeding 300 mm and connect opposite walls with two polyethylene braids after each lift.

1. GENERAL

This Section specifies requirements for supplying and placing rock rip-rap.

1.1 Related Work

- | | | |
|----|--------------------------------|------------------|
| .1 | Geotextiles | Section 31 32 21 |
| .2 | Corrugated Steel Pipe Culverts | Section 33 42 13 |

1.2 References

- | | |
|----|--|
| .1 | CAN/CSA-A3001, Cementitious Materials. |
| .2 | CSA A82.56, Aggregate for Masonry Mortar. |
| .3 | CAN/CSA-A23, Concrete Material and Methods of Concrete Construction. |

2. PRODUCTS

2.1 Stone

- .1 Hard, dense, durable stone, free from seams, cracks, or other structural defects, to meet the following size distribution for the use intended:

Nominal Mass	40 kg or
Nominal Diameter	300 mm
None heavier than	130 kg or 450 mm
No less than 20% or more than 50% heavier than	70 kg or 350 mm
No less than 50% or more than 80% heavier than	40 kg or 300 mm
100% heavier than	3 kg or 125 mm

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

2.2 Cement Mortar

- | | |
|----|---|
| .1 | Portland cement: To CAN/CSA-A3001, type GU. |
| .2 | Sand for mortar: To CSA A82.56. |

- .3 Mortar mix: One part by volume of cement to three parts sand, to consistency approved by the Engineer.

2.3 Geotextile

- .1 To Section 31 32 21 - Geotextiles.

3. EXECUTION

3.1 Placing

- .1 Where rip-rap is to be placed on slopes, excavate trench at toe of slope to dimensions as indicated.
- .2 Fine grade area to be rip-rapped to uniform, even surface. Fill depressions with suitable material and compact to provide firm bed.
- .3 Place geotextile on prepared surface as indicated. Place rip-rap on geotextile so as to avoid puncturing geotextile. Do not drive vehicles directly on geotextile.
- .4 Place rip-rap to thickness and details as indicated.
- .5 Place stones in manner approved by the Engineer to secure surface and create a stable mass. Place larger stones at bottom of slopes.
- .6 Hand Placing
 - .1 Use larger stones for lower courses and as headers for subsequent courses.
 - .2 Stagger vertical joints and fill voids with rock spalls or cobbles.
 - .3 Finish surface even, free of large openings, and neat in appearance.
- .7 Mortar
 - .1 Use mortar within one hour after water has been added. Do not add additional water after initial mixing.
 - .2 Commence applying mortar at bottom courses and work upward completely filling voids except for sub-drainage relief holes as indicated, and leaving outer faces of stones exposed. Remove excess mortar to expose faces of stones.
 - .3 Cure and protect mortar in accordance with CAN/CSA-A23.1 using absorptive mats or fabric kept continuously wet.

Section 32 01 12	Pavement Marking Removal	Section 32 32 20	Interlocking Block Retaining Wall
Section 32 01 18	Routing and Sealing Pavement Cracks	Section 32 91 21	Topsoil and Finish Grading
Section 32 01 21	Pavement Crack Cleaning and Filling	Section 32 92 20	Mechanical Seeding
Section 32 11 13	Reshaping Granular Roadbed	Section 32 92 21	Hydraulic Seeding
Section 32 11 19	Granular Sub-Base	Section 32 92 23	Sodding
Section 32 11 23	Granular Base	Section 32 93 45	Tree Pruning
Section 32 12 14	Asphalt Prime Coat		
Section 32 12 15	Asphalt Tack Coat		
Section 32 12 16	Hot-Mix Asphalt Concrete Paving		
Section 32 12 20	Mixed-in-Place Asphalt Paving		
Section 32 12 50	Asphaltic Concrete Overlay Paving		
Section 32 12 53	Reshaping Asphalt Pavement (Milling)		
Section 32 13 14	Removal and Replacement of Concrete Work		
Section 32 13 15	Concrete Work		
Section 32 14 20	Precast Paving Stone		
Section 32 17 13	Pavement Marking: General		
Section 32 17 23	Painting Traffic Lines and Markings		
Section 32 17 33	Thermoplastic Pavement Markings		
Section 32 31 13	Chain Link Fences and Gates		
Section 32 31 16	Post and Cable Fence		

1. GENERAL

This Section specifies requirements for removal of pavement markings.

1.2 Related Work

.1	Cleaning	Section 01 74 11
.2	Hot-Mix Asphaltic Concrete Paving	Section 32 12 16
.3	Asphalt Tack Coat	Section 32 12 15

2. PRODUCTS

2.1 Materials

- .1 Abrasives used for removal of painted pavement markings to be products specifically designed for sand blasting.
- .2 Resin based compound with granular material surface coating (e.g. System 400) are not an approved filter material

3. EXECUTION

3.1 Removals

- .1 Non-Approved Removal Processes:
 - .1 Painting or blacking out the marking and / or leaving the marking to wear out over time.
 - .2 Heater milling equipment
- .2 Removal Processes: Thermoplastic
 - .1 Grind out line marking and underlying asphalt to the width and length of the line and a depth of 25mm below the adjacent pavement surface.
 - .2 Grind out symbol marking and underlying asphalt to a rectangular area equal to the width and length of the symbol and a depth of 25mm below the adjacent pavement surface.
 - .3 Spray type and cold plastic line and symbol markings to be ground off.

.3 Removal Process: Paint

.1 Paint markings to be sandblasted.

.4 Exercise care to avoid dislodgement of coarse aggregate particles, excessive removal of fines, damage to bituminous binder, or damage to joint and crack sealers.

.5 All residues from operations to be removed from site and disposed of by the contractor.

3.2 Repair

.1 No repair is required for removal of painted, spray type and/or cold pavement markings

.2 Grooves remaining after removal of thermoplastic inlaid pavement markings to be filled using Type 5a Asphaltic Concrete Pavement. Apply an asphalt tack coat before placing asphalt filler.

1. GENERAL

This Section specifies requirements for repairing cracks in existing pavement that is not being overlaid within one year.

1.1 Related Work

- .1 Cleaning Section 01 74 11

2. PRODUCTS

2.1 Materials

- .1 Hot-poured rubberized asphalt may be one of the following approved products.
 - Beram 195 LM
 - Beram 3060 LM
 - Permaquik 6190 LM
 - Crafeo 522
 - Deery 101 ELT
- .2 Other equal products may be approved for use on a trail bases on select town streets as designated by the Public Works Department.

3. EXECUTION

3.1 Equipment

- .1 Router and Cutter Bits
 - .1 Routers shall be flexible and portable as required to follow random cracking.
 - .2 Routers shall have cutter bits that will cut a minimum size groove 20mm wide and 10mm deep.
- .2 Compressed Air Equipment
 - .1 Compressors shall have a capacity of 2 m³/min or greater at 550 kPa, and be oil and water free.
 - .2 Air shall be delivered through a blow-pipe with a maximum diameter of 16 mm to ensure an airstream capable of effectively cleaning out the routed cracks.
- .3 Hot air lance as approved by the Engineer.
- .4 A portable oil jacketed type double boiler melter with a mechanically operated agitator and separate thermometric controls and gauges for sealant and heat

transfer oil shall be used when applying rubberized asphalt. A tar kettle may be used for catalytic asphalt.

- .5 Pouring pots shall have an oblong body, no-splash top, drip-tight fingertip control valve, and minimum sized pouring tip to prevent overspray.

3.2 Preparation

- .1 A review of surfaces to be crack sealed shall be undertaken with the Engineer to establish physical limits of cracks to be sealed.
- .2 All cracks designated by the Engineer for sealing shall be routed to a minimum width of 20mm and a depth of 10mm. Router cut shall be perpendicular to the pavement surface.
- .3 Routed cracks must be dry, free from frost, laitance, residual dust and debris. Cracks shall be cleaned immediately prior to sealing using compressed air equipment and other mechanical means as required. Cracks shall be completely cleaned to expose freshly routed surfaces.

3.3 Placing of Sealant

- .1 Sealant shall be melted in accordance with Manufacturer's instructions. Diluted, overheated or burned materials shall be removed from work site and suitably disposed of.
- .2 Melted sealant shall be placed into routed cracks in accordance with manufacturer's instructions. Sealant shall be placed using a pouring pot or approved pressure wand, then levelled with an approved squeegee, flush with pavement surface and shall not be more than 3 mm below pavement surface after cooling.
- .3 Crack sealant is to be sprayed with liquid soap or dusted with limestone or flyash immediately after being placed, to stop traffic from tracking or pulling out sealant.
- .4 Sealant spilled on pavement surface shall be removed and area sprinkled lightly with fine sand.
- .5 Place sealant when air temperature is above 10° C and daily low temperature does not fall below 5° C and no rain is forecast.

3.4 Cleanup

- .1 Clean all sidewalks of debris blown from routed cracks. Sweep debris onto roadway for removal by street sweepers.
- .2 Avoid router tailings and excess covering material from entering into the drainage system.

1. GENERAL

This Section specifies requirements for repairing cracks in pavement surfaces prior to surface treatments or overlays (crown paving).

1.1 Samples

- .1 Submit to the Engineer, at least two weeks prior to commencing work, the following samples of materials proposed for use:
 - .1 One 4 L container of asphalt material. Submit emulsions in a plastic container.
 - .2 One 20 kg sample of each aggregate gradation.
- .2 Provide access for the Engineer to sample materials actually incorporated into work as required.

2. PRODUCTS

2.1 Materials

- .1 Anionic emulsified asphalt to CAN2-16.2, grade SS-1.
- .2 Cutback asphalt to CAN2-16.1 grade RC-250.
- .3 Aggregate for crack filling to be clean sand or crushed screenings with a sand equivalent not less than 45% when tested to ASTM D2419.
- .4 Aggregate gradation to be within following limits when tested to ASTM C136 and ASTM C117 (AASHTO T27 and T11).
 - .1 For sand-asphalt slurry using emulsion:

<u>Sieve Size (microns)</u>	<u>% Passing</u>
2,500	100
315	25 - 50
200	12 - 30
80	3 - 12
 - .2 For sand asphalt mix using cutback asphalt:

<u>Sieve Size (microns)</u>	<u>% Passing</u>
2,500	100
80	0 - 8
- .5 Mixing water; potable.

2.2 Mixes

- .1 Determine exact proportions for preparing filling mixes by site conditions and

subject to approval of the Engineer.

- .2 Prepare sand asphalt slurry or mix with approximate following proportions:
 - .1 50 kg of aggregates.
 - .2 10 to 16 L of asphalt.
 - .3 Water to produce uniform slurry of consistency to achieve full penetration into cracks.

3. EXECUTION

3.1 Application Equipment

- .1 Pouring pots or approved pressure wand.

3.2 Preparation

- .1 Clean cracks designated by the Engineer.
- .2 Remove by use of hooks or other suitable tools and loose materials from spalled edges, from surface and to a minimum depth of 50 mm.
- .3 Clean loose material from cracks with compressed air, free of oil and water, applied at pressure not less than 550 kPa, or by other approved means.
- .4 Dispose of material removed from cracks as directed. Do not contaminate drainage system.

3.3 Crack Filling

- .1 Fill cracks exceeding a width of 3 mm.
- .2 Fill cracks when air temperature is above 10° C and daily low temperature does not fall below 5° C, and no rain is forecast.
- .3 Cracks shall be clean and dry.
- .4 Fill and tamp cracks to minimum 50 mm depth and level with pavement surface. Due to shrinkage of mixture, two or more separate applications may be required for tight sealing.
- .5 Remove and dispose of excess filler material as directed.

1. GENERAL

This Section specifies requirements for scarifying and reshaping of existing granular roads and lanes with addition of new granular base material where required, to lines, grades, and typical cross section as indicated or as established by the Engineer.

1.1 Related Work

.1	Roadway Embankment and Compaction	Section 31 24 13
.2	Aggregate Materials	Section 31 05 17
.3	Granular Base	Section 32 11 23

2. PRODUCTS

2.1 Materials

- .1 Granular base aggregate to be 20 mm crushed gravel. Gradation to be in accordance with Section 31 05 17 - Aggregate Materials.

3. EXECUTION

3.1 Waste Excavation

- .1 Remove contaminated gravel, clay, and other deleterious material and haul to designated waste disposal site.

3.2 Scarifying and Reshaping

- .1 Scarify remaining granular base material as directed by the Engineer to maximum depth of remaining granular base material, or 100 mm, whichever is least.
- .2 Blade and trim scarified material to elevation and cross section dimensions indicated or as directed by the Engineer.
- .3 Where a deficiency of material exists, add and blend in new granular base material as directed by the Engineer.

3.3 Compacting

- .1 Compact to a density not less than 100% Standard Proctor Density.
- .2 Shape and roll alternately to obtain smooth, even, and uniformly compacted base.
- .3 Apply water as necessary during compaction to obtain specified density. If material is excessively moist, aerate by scarifying with suitable equipment until moisture content is corrected.

- .4 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by the Engineer.

3.4 Tolerance

- .1 Reshaped compacted surface shall be within ± 10 mm of elevation as indicated.

1. GENERAL

This Section specifies requirements for supplying, producing, placing and compacting granular sub-base to lines, grades, and typical cross sections indicated on plans or as directed.

1.1 Definitions

- .1 Sub-base: Design depth of granular material constructed immediately on the prepared subgrade and prior to construction of base material.

1.2 Related Work

- | | | |
|----|-----------------------------------|------------------|
| .1 | Roadway Embankment and Compaction | Section 31 24 13 |
| .2 | Aggregate Materials | Section 31 05 17 |
| .3 | Granular Base | Section 32 11 23 |

1.3 Measurement for Payment

- .1 Sub-base to be measured in square metres of compacted material incorporated into work in accordance with design.
- .2 Unit price bid shall be full compensation for all work involved in supplying and installing as described in Clause 3 – Execution of this Section.

2. PRODUCTS

2.1 Materials

- .1 Sub-base aggregate shall consist of the following:
 - .1 Native fill sand
 - .2 75 mm or 150 mm pitrun gravel
- .2 Gradation to be in accordance with Section 31 05 18 – Aggregate material.
- .3 Material to be used as specified by the Engineer, or as shown on the drawings.
- .4 Liquid limit: ASTM D423, maximum 25.
- .5 Plasticity index: ASTM D424, maximum 6.

3. EXECUTION

3.1 Inspection of Existing Subgrade Surface

- .1 Do not place material until finished subgrade is inspected by the Engineer.

3.2 Placing

- .1 Place material only on a clean unfrozen surface, properly shaped and compacted and free from snow or ice.
- .2 Where specified by the Engineer, place geotextile in accordance with Section 31 32 21 Geotextiles.
- .3 Begin spreading sub-base material on a crown line or high side of a one-way slope.
- .4 Place materials using methods which do not lead to segregation or degradation.
- .5 For spreading and shaping material, use spreader boxes having adjustable templates or screens which will place material in uniform layers of required thickness.
- .6 Place material in uniform layers not exceeding 150 mm when compacted or to such other depth as approved.
- .7 Shape each layer to a smooth contour and compact before succeeding layer is placed.
- .8 Remove and replace portion of a layer in which material has become segregated during spreading.

3.3 Compacting

- .1 Compact to a uniform density of not less than 100% Standard Proctor unless otherwise approved by the Engineer.
- .2 Shape and roll alternately to obtain a smooth, even and uniformly compacted sub-base.
- .3 Apply water as necessary during compaction to obtain specified density. If sub-base is excessively moist, aerate by scarifying with suitable equipment until moisture content is corrected.
- .4 In areas not accessible to rolling equipment, compact to specified density with approved mechanical tampers.
- .5 Verify density by proof-rolling.

3.4 Finish Tolerances

- .1 Finish compacted surface to within ± 10 mm of established grade but not uniformly high or low.
- .2 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

3.5 Proof Rolling

- .1 For proof rolling use a roller of 45400 kg gross mass with four pneumatic tires each carrying 11350 kg and inflated to 620 kPa. Four tires arranged abreast with centre to centre spacing of 915 mm maximum.
- .2 The Engineer may authorize use of other acceptable proof rolling equipment.
- .3 Proof roll at level in sub-base indicated by the Engineer.
- .4 Make sufficient passes with proof roller to subject every point on surface to three separate passes of a loaded tire.
- .5 Where proof rolling reveals areas of defective subgrade or sub-base remove to depth and extent directed and replace with new materials to requirements of Section 31 24 13 – Roadway Embankment and Compaction, and this Section at no extra cost to the Owner.

3.6 Maintenance

- .1 Maintain finished sub-base in condition conforming to this Section until succeeding base is constructed, or is accepted by the Engineer.

1. GENERAL

This Section specifies requirements for supplying, producing, placing, and compacting crushed gravel a granular base to lines, grades, and typical cross sections indicated on plans or as directed.

1.1 Related Work

- | | | |
|----|-----------------------------------|------------------|
| .1 | Roadway Embankment and Compaction | Section 31 24 13 |
| .2 | Aggregate Materials | Section 31 05 17 |
| .3 | Granular Sub-Base | Section 32 11 19 |

1.2 Definitions

- | | |
|----|--|
| .1 | Base: Design depth of granular base constructed immediately on sub-base and prior to asphaltic pavement. |
|----|--|

2. PRODUCTS

2.1 Materials

- | | |
|----|--|
| .1 | Granular base aggregate to be 20 mm crushed gravel. Gradation to be in accordance with Section 31 05 17 - Aggregate Materials. |
| .2 | Liquid Limit: ASTM D423 (AASHTO T89), maximum 25. |
| .3 | Plasticity Index: ASTM D424 (AASHTO T90), maximum 6. |
| .4 | Los Angeles Abrasion: ASTM C131 (AASHTO T6), maximum % loss by weight - 45. |
| .5 | Crushed fragments: minimum 60% of fragments within each size range to have at least two freshly fractured faces. |

3. EXECUTION

3.1 Inspection of Sub-base

- | | |
|----|--|
| .1 | Do not place granular base until finished sub-base or subgrade surface is inspected by the Engineer. |
|----|--|

3.2 Placing

- | | |
|----|--|
| .1 | Place material only on a clean unfrozen surface, properly shaped and compacted and free from snow and ice. |
| .2 | Begin spreading base material on a crown line or on high side of a one-way slope. |

- .3 Place using methods which do not lead to segregation or degradation of aggregate.
- .4 For spreading and shaping material, use spreader boxes having adjustable templates or screens which will place material in uniform layers of required thickness.
- .5 Place material in uniform layers not exceeding 150 mm when compacted or to such other depth as approved by the Engineer.
- .6 Shape each layer to a smooth contour and compact before succeeding layer is placed.
- .7 Remove and replace that portion of a layer in which material becomes segregated during spreading.

3.3 Compacting

- .1 Compact to a density not less than 100% of Standard Proctor, At optimum moisture content, unless otherwise approved by the Engineer.
- .2 Shape and roll alternately to obtain a smooth, even and uniformly compacted base.
- .3 Apply water as necessary during compacting to obtain specified density. If material is excessively moist, aerate by scarifying with suitable equipment until moisture content is corrected.
- .4 In areas not accessible to rolling equipment, compact to specified density with approved mechanical tampers.
- .5 Verify density by proof rolling.

3.4 Finish Tolerances

- .1 Finished base surface shall be within ± 10 mm of established grade but not uniformly high or low.
- .2 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

3.5 Proof Rolling

- .1 For proof rolling use a roller of 45400 kg gross mass with four pneumatic tires each carrying 11350 kg and inflated to 620 kPa. Four tires arranged abreast with centre to centre spacing of 915 mm maximum.
- .2 The Engineer may authorize use of other acceptable proof rolling equipment.
- .3 Proof roll top of base upon completion of fine grading and compaction.

- .4 Make sufficient passes with proof roller to subject every point on surface to three separate passes of a loaded tire.
- .5 Where proof rolling reveals defective base or sub-base, remove defective materials to depth and extent directed and replace with new materials to requirements of Section 31 24 13 – Roadway Embankment and Compaction, and Section 32 11 19 – Granular Sub-Base, and this Section at no extra cost to the Owner.

3.6 Maintenance

- .1 Maintain finished base in a condition conforming to this Section until succeeding material is applied or until acceptance by the Engineer.

1. GENERAL

This Section specifies requirements for furnishing and applying asphalt to an absorbent surface.

1.1 Related Work

.1	Traffic Control	Section 01 35 14
.2	Granular Base	Section 32 11 23
.3	Hot-Mix Asphalt Concrete Paving	Section 32 12 16
.4	Asphaltic Concrete Overlay Paving	Section 32 12 50

1.2 Samples

- .1 If requested, submit to the Engineer one 4 litre container of asphalt material proposed for use in work, at least two weeks prior to commencing operations.

1.3 Measurement of Payment

- .1 Asphalt prime coat to be measured in square metres based on nominal pavement widths shown on drawings. Unit bid tendered shall be full compensation for all work involved in supplying the tack coat and installing it as specified in Claus 3 – Execution of this Section.

2. PRODUCTS

2.1 Materials

- .1 The Contractor's choice of SEP-1, SEP-2, or SS-1 for application through August 31 each season. The Contractor's choice of MC-30, SEP-1, SEP-2, or SS-1 for application after August 31 each season.
- .2 Sand used for the blotting of excess asphalt due to prime shall be supplied by the Contractor.

3. EXECUTION

3.1 Asphalt Distributor

- .1 Distributor to be designed, equipped, maintained and operated such that asphalt material:
 - .1 Maintains an even temperature.
 - .2 Is applied uniformly on variable surface widths up to 5.6m.
 - .3 Is applied at controlled rates from 0.3 to 2.0 litres per square metre, with

uniform pressure and with an allowable variation from any specified rate not to exceed 0.1 litre per square metre.

- .4 Capable of uniform spray without atomization at rate specified and temperature required.
- .2 Pump to operate by a separate power unit independent of truck power unit.
- .3 Equipped with an easily read, accurate device which registers temperature of liquid in reservoir.
- .4 Equipped with accurate volume measuring devices or a calibrated tank.

3.2 Preparation

- .1 Provide appropriate traffic warning signage as per Section 01 35 14 – Traffic Control.
- .2 Shape surface to proper cross section.
- .3 Have surface approved by the Engineer before applying prime material.
- .4 The Engineer may authorize a light spraying of water to moisten an excessively dry and dusty surface to aid penetration of asphalt prime.

3.3 Application

- .1 Heat asphalt material to temperatures required for pumping and spraying without fogging according to following table:

<u>Asphalt</u>	<u>Temperature Range</u>
RC 70 or MC 70	49 to 88°C
RC 250 or MC 250	74 to 110°C

- .2 Apply asphalt material only when surface is dry or slightly damp and air temperature is 10°C and rising. Do not apply when rain is forecast.
- .3 Apply prime material to granular base at a rate of 0.5 to 1.75 l/m².
- .4 Keep traffic off treated areas until liquid has cured, set or been absorbed.
- .5 Prevent overlap at junction of spreads.
- .6 Correct areas not sufficiently covered.
- .7 Take precautions to prevent curbs, gutters, traffic, or parked vehicles from being sprayed with asphalt.

Use of Sand Blotter

- .1 If prime material fails to penetrate within a reasonable time, spread sand blotter material in amounts required to absorb any excess asphalt material.
- .2 Sweep up and remove excess blotter material. Do not allow contaminated material to enter drainage system.

1. GENERAL

This Section specifies requirements for furnishing and applying asphalt to existing asphaltic concrete and Portland concrete surfaces in accordance with these specifications.

1.1 Related Work

.1	Traffic Control	Section 01 35 14
.2	Asphalt Pavement Removal	Section 02 41 14
.3	Hot-Mix Asphalt Concrete Paving	Section 32 12 16
.4	Asphaltic Concrete Overlay Paving	Section 32 12 50

1.2 Samples

- .1 If requested, submit to the Engineer one 4-litre container of asphalt material proposed for use in work, at least two weeks prior to commencing operations.

1.3 Measurement of Payment

- .1 Asphalt tack coat to be measured in square metres of area coated and based on the measured area of asphaltic concrete placed. Unit bid tendered shall be full compensation for all work involved in supplying the tack coat and installing it as specified in Clause 3 – Execution of this Section.

2. PRODUCTS

2.1 Materials

- .1 Tack Coat

SS-1 for application through August 31 each season. The Contractor's choice of RC-30, RC-70, or SS-1 for application after August 31 each season.
- .2 Fog Coat

SS-1 for application through August 31 each season. The Contractor's choice of MC-30 or SS-1 for application after August 31 each season.

3. EXECUTION

3.1 Asphalt Distribution

- .1 Distributor to be designed, equipped, maintained and operated such that asphalt material.

- .1 Maintains an even temperature.
- .2 Is applied uniformly on variable surface widths up to 5.6m.
- .3 Is applied at controlled rates from 0.3 to 0.5 litres per square metre, with uniform pressure and with an allowable variation from any specified rate not to exceed 0.1 litre per square meter.
- .4 Capable of a uniform spray without atomization at rate specified and temperature required.
- .2 Capable of distributing asphalt material in a uniform spray without atomization at rate specified and temperature required.
- .3 Pump to operate by a separate power unit independent of truck power unit.
- .4 Equipped with an easily read, accurate device which registers temperature of liquid in reservoir.
- .5 Equipped with accurate volume measuring devices or a calibrated tank.

3.2 Preparation

- .1 Provide appropriate traffic warning signage as per Section 01 35 14 – Traffic Control.
- .2 Clean surface as directed in Section 02 41 14 – Asphalt Pavement Removal.
- .3 Have surface approved by the Engineer before applying tack coat.

3.3 Application

- .1 Heat asphalt material to temperature required for pumping and spraying without fogging according to following table:

<u>Asphalt</u>	<u>Temperature Range</u>
SS-1 or SS-1h	24 to 54°C
RC 30, RC 70	49 to 88°C
MC 30	As per manufacturer directions

- .2 Apply asphalt material only when surface is dry or slightly damp and air temperature is 10°C and rising. Do not apply when rain is forecast.
- .3 Apply tack or fog coat material to existing pavement surface at a rate of 0.3 to 0.5/l m².
- .4 If SS-1 is used for fog coat, the material, as delivered by the supplier, shall be diluted by adding an amount of water to be determined by the Contractor.

- .5 Prevent overlap at junction of spreads.
- .6 Correct areas not sufficiently covered.
- .7 Take precautions to prevent curbs, gutters, traffic, or parked vehicles from being sprayed with asphalt.
- .8 Do not allow excess liquid asphalt material to enter the storm drainage system.
- .9 Keep traffic off treated areas until liquid has cured, set or been absorbed.

1. GENERAL

This Section specifies requirements for producing and placing hot-mix asphalt concrete including supply of aggregates and bituminous binder.

1.1 Related Work

.1	Traffic Control	Section 01 35 14
.2	Quality Control	Section 01 45 00
.3	Aggregate Materials	Section 31 05 17
.4	Asphalt Prime Coat	Section 32 12 14
.5	Asphalt Tack Coat	Section 32 12 15
.6	Asphaltic Concrete Overlay Paving	Section 32 12 50
.7	Pavement Markings General	Section 32 17 13
.8	Painted Traffic Lines and Markings	Section 32 17 23
.9	Thermoplastic Pavement Markings	Section 32 17 33

1.2 Definitions

- .1 Table A, appended to this Section, lists general uses for each type of asphaltic concrete mixtures based on asphaltic concrete aggregate gradation sizes specified under Section 31 05 17 – Aggregate Materials.

2. PRODUCTS

2.1 Asphalt Cement

- .1 Asphalt cement to penetration grade 150 - 200 A to CGSB-16.3 and possess the properties as shown in Table B appended to this Section.
- .2 Provide approved storage, heating tanks, and pumping facilities for asphalt cement.

2.2 Aggregates

- .1 Asphaltic concrete aggregate shall be crushed gravel. Gradation shall be in accordance with Section 31 05 17 - Aggregate Materials Table ' A ' designation 5, and as specified herein. Maximum permissible gradation variation as per Table C appended to this Section.
- .2 Sand equivalent: ASTM D2419 (AASHTO T176), minimum 50%. One test per mix design.

- .3 Magnesium Sulphate soundness: ASTM C88 (AASHTO T104) percentage loss by mass, coarse aggregate: 18, fine aggregate 20. One test per aggregate source, or as requested by the Engineer.
- .4 Los Angeles Abrasion: ASTM C131 (AASHTO T96), maximum percentage loss by mass, coarse aggregate: 40. One test per aggregate source, or as requested by the Engineer.
- .5 Absorption: ASTM C127 (AASHTO T85), maximum percentage by mass, coarse aggregate: 1.75. One test per mix design.
- .6 Loss by washing: ASTM C117 (AASHTO T11), maximum percentage passing 80 micron sieve, coarse aggregate: 1.5. One test per mix design.
- .7 Lightweight particles: ASTM C123 (AASHTO T150), maximum percentage by mass less than 1.95 relative density: 1.5. One test per mix design.
- .8 Flat and elongated particles: (with length to thickness ratio greater than 5), maximum percentage by mass, coarse aggregate: 15. One test per mix design.
- .9 Crushed fragments: minimum percentage by mass with minimum of two freshly fractured faces. Retained on 5 mm sieve, coarse aggregate: 60.
- .10 Regardless of compliance with specified physical requirements, aggregates may be accepted or rejected on basis of past field performance. One test for each extraction sample.
- .11 Stockpile minimum 50% of total amount of aggregate required before commencing asphalt mixing operation.
- .12 When dryer drum mixing plant is used, stockpile fine aggregate separately from coarse aggregate.

2.3 Manufactured Fines

- .1 Manufactured fines to Section 31 05 17 – Aggregate Materials.
- .2 Add manufactured fines when necessary to meet job mix aggregate gradation or as directed to improve mix properties.

2.4 Mix Design

- .1 Preparation and submission of asphalt mix design for the Engineer's approval is the responsibility of the Contractor. The Contractor shall use professional engineering services and a qualified testing laboratory to assess the aggregate materials proposed for use and to carry out the design of the asphalt mixture. The mix design is to be submitted to the Engineer for approval at least two weeks prior to commencing paving operations.
- .2 The asphalt mix design shall follow the Marshall method of Mix Design as outlined in the latest edition of the Asphalt Institute Manual Series No. 2 (MS-2).

The Mix Design, at the design Asphalt Content, shall meet the requirements shown in Table D, appended to this Section, for the Asphalt Mix Type specified.

- .3 Physical requirements to be measured as follows:
 - .1 Marshall stability and flow index to ASTM D1559.
 - .2 Air voids to ASTM D3203.
 - .3 Voids in mineral aggregate to ASTM C127 and ASTM C128 with allowance for volume of asphalt absorbed in aggregate.
- .4 Submit the following with mix design:
 - .1 Temperature of asphalt during mixing in plant.
 - .2 Temperature of asphalt immediately prior to compaction.
- .5 Do not change mix design without prior written approval of the Engineer.
- .6 Should a change in material source be proposed, new mix design must be approved by the Engineer.

2.5 Field Quality Testing

- .1 The Owner may retain the services of a materials testing firm to carry out field quality tests as follows:
 - .1 Aggregate Gradation: One aggregate gradation test for each 300 tonnes of production, or at least one per day (ASTM C136).
 - .2 Mix Quality: At least one test of three briquettes for each 1000 tonnes of production, and at least one test per day for each of:
 - .1 Marshall Stability ASTM D 1559
 - .2 Specific Gravity ASTM D 2726
 - .3 Air Voids and VMA ASTM D 3203
 - .4 Flow Index ASTM D 1559, C29
 - .5 Asphaltic Content Extraction and Sieve Analysis ASTM D 2172
ASTM C 117 and
C 136
- .3 Field Density, Asphalt Thickness, and Asphalt Content: After asphaltic concrete has been laid and compacted, one pavement core from approximately each 1000 sq m of pavement will be obtained at locations determined by the Engineer. Cross sectional depth of core will be measured to determine asphalt thickness. Density of core will be

measured and compared with the Marshall density taken from field samples of the asphalt mix placed in the area of the core. Asphalt content will be determined and compared to the recommended asphalt content determined in the asphalt mix design.

- .2 If core test results fail to satisfy thickness, density, or asphalt content requirements as specified, the Contractor shall immediately modify his construction procedures to produce a uniformly compacted surface which will satisfy density and thickness requirements. Sections with inadequate compaction or thickness shall be subject to a payment reduction as defined under Clauses 2.6, 2.7, and 2.8 or rejected, as directed by the Engineer.
- .3 The core test result will be deemed to represent the approximate 1000 m² area from which it was taken depending on location of other cores taken. Boundaries of area represented by the core test results will be determined by the Engineer.
- .4 If initial core is found to be deficient, two additional cores within each deficient area may be taken by an independent qualified testing firm at the Contractor's expense, in locations approved by the Engineer. In this case, additional core test results will be averaged with first result to represent area in question.
- .5 The Contractor shall give written notice to the Engineer, 48 hours in advance of any paving operations, to make arrangements for testing.
- .6 If test results indicate non-compliance with Specifications, pavement may be rejected by the Engineer. Pavement thus rejected shall be removed and replaced at the Contractor's expense.
- .7 Cost of additional testing made necessary by the Contractor's unsatisfactory workmanship or materials will be charged to the Contractor.
- .8 The Contractor shall perform all tests necessary to control the quality of his materials and workmanship, and ensure that his work complies with the Section 01 45 00 – Quality Control.

2.6 Asphalt Concrete Thickness Tolerances

- .1 For areas deficient in thickness, the contract unit price to be adjusted as follows:
 - .1 No payment for areas deficient in thickness by more than 15 mm.
 - .2 No adjustment in unit price for areas thicker than required.
 - .3 For areas deficient in thickness by more than 5 mm and less than 15 mm, of the design thickness, the unit price is to be reduced as per Table E appended to this Section.
 - .4 These pay factors will not apply to asphalt tendered on a per tonne basis.

2.7 Asphalt Density Tolerances

- .1 Each mat of hot-mix asphalt placed shall be compacted to minimum density (percentage of Marshall Density) specified for type of pavement as per Table F appended to this Section.

If asphalt density is found to be deficient according to core tests described under Clause 2.5 of this Section, payment for asphaltic concrete surface course within area represented by core(s) will be reduced. Payment reduction will be equal to unit rate tendered (for asphaltic concrete surface course in question), multiplied by Payment Reduction Factor (derived from Table G under the appropriate density column as specified in Table F. Table are appended to this Section).

In multi-lift pavements, payment reduction may be applied to individual lifts of pavement; in which case unit price used to calculate payment reduction would be determined by the Engineer based on depth of asphaltic lift in proportion to depth of full asphaltic concrete portion of pavement.

- .2 No adjustment to the unit price to be made for areas with a density higher than that specified.

2.8 Asphalt Content

- .1 If asphalt content is found to be deficient according to core tests described under Clause 2.5 of this Section, payment for asphalt content within area represented by core(s) will be reduced. Payment reduction will be equal to Unit rate tendered (for asphaltic concrete surface course in question), multiplied by Payment Reduction Factor derived from the appropriate payment reduction factor as shown in Table H appended to this Section.

In multi-lift pavements, payment reduction may be applied to individual lifts of pavement; in which case unit price used to calculate payment reduction would be determined by the Engineer based on depth of asphaltic lift in proportion to depth of full asphaltic concrete portion of pavement.

2.9 Application of Reduced Unit Price

- .1 The application of a reduced unit price pursuant to Clauses 2.6, 2.7, and 2.8 does not relieve the Contractor of his Contract Maintenance requirements.

3. EXECUTION

3.1 Plant and Mixing Requirements

- .1 Batch and continuous mixing plants to ASTM D995 and Asphalt Institute Manuals.

3.2 Equipment

- .1 Pavers: mechanical self-powered pavers with automatic screed controls, capable of spreading mix within specified tolerances, true to line, grade, and crown indicated.
- .2 Rollers: sufficient number of self-propelled rollers of type and weight to obtain specified density of compacted mix.
- .3 Haul trucks: of adequate size, speed, and condition to ensure orderly and continuous operation and as follows:
 - .1 Boxes with tight metal bottoms.
 - .2 Covers of sufficient size and weight to completely cover and protect asphalt mix when truck fully loaded.
 - .3 In cool weather or for long hauls, insulate entire contact area of each truck box.
- .4 Hand tools:
 - .1 Lutes or rakes with covered teeth during spreading and finishing operations.
 - .2 Tamping irons having mass not less than 12 kg and a bearing area not exceeding 310 cm² for compacting material along curbs and other areas inaccessible to roller. Mechanical compaction equipment, when approved by the Engineer, may be used instead of tamping irons.
 - .3 Straight edge, 3.0 m in length, to test finished surface.

3.3 Preparation

- .1 Written notice of intention to begin paving operations to be given to the Engineer 24 hours in advance.
- .2 Provide appropriate and adequate traffic warning signage as per Section 01 35 14 – Traffic Control.
- .3 When paving over existing asphalt surface, clean pavement surface in accordance with Section 32 12 50 - Asphaltic Concrete Overlay Paving.
- .4 Clean pavement surface in accordance with Section 01 74 11 – Cleaning.
- .5 When levelling course is not required, patch and correct depressions and other irregularities to approval of the Engineer before beginning paving operations.
- .6 Apply prime coat or tack coat where directed in accordance with Section 32 12 14 – Asphalt Prime Coat or 32 12 15 – Asphalt Tack Coat, prior to paving.

- .7 Paint contact surfaces of existing structures such as manholes, curbs or gutters with bituminous material prior to placing adjacent pavement.
- .8 Traffic shall not be permitted to travel on tack or prime coat until it has cured. Provide flagmen, if required, to control traffic.

3.4 Transportation of Mix

- .1 Transport mix to job site in vehicles cleaned of foreign material.
- .2 Paint or spray truck beds with light oil, limewater, or detergent solution, at least once a day or as required. Elevate truck bed and thoroughly drain. No excess solution or use of gasoline, kerosene, or similar product will be permitted.
- .3 Schedule delivery of material for placing in daylight, unless the Engineer approves artificial light.
- .4 Deliver loads continuously in covered vehicles and immediately spread and compact.
- .5 Deliver material to paver at a uniform rate and in an amount within capacity of paving and compacting equipment.
- .6 Deliver and place mixes at a temperature between 125°C and 150°C.

3.5 Placing

- .1 Place asphalt concrete to thickness, grades, and lines indicated on Drawings or directed by the Engineer.
- .2 Placing conditions:
 - .1 Place asphalt mixtures only when air temperature is above 5°C.
 - .2 When temperature of surface on which material is to be placed falls below 10°C, provide extra rollers as necessary to obtain required compaction before cooling.
 - .3 Do not place hot-mix asphalt when pools of standing water exist on surface to be paved, during rain, or when surface is damp.
- .3 Place asphalt concrete in compacted lifts of 75 mm maximum depth.
- .4 Spread and strike off mixture with self-propelled mechanical finisher as follows:
 - .1 Construct longitudinal joints and edges parallel to line markings. Lines for paver to follow parallel to centre line of proposed pavement. Position and operate paver to follow established line closely.
 - .2 When using pavers in echelon, have first paver follow marks or lines, and second paver follow edge of material placed by first paver. Work pavers

- as close together as possible and in no case permit them to be more than 30 m apart.
- .3 If segregation occurs, immediately suspend spreading operation until cause is determined and corrected.
- .4 Correct irregularities in alignment left by paver by trimming directly behind machine.
- .5 Correct irregularities in surface of pavement course directly behind paver. Remove by shovel or lute excess material forming high spots. Fill and smooth indented areas with hot-mix. Do not broadcast material over such areas.
- .6 Do not throw surplus material on freshly screeded surfaces.
- .5 When hand spreading is used:
 - .1 Wood or steel forms, approved and rigidly supported to assure correct grade and cross section, may be used. Use measuring blocks and intermediate strips to aid in obtaining required cross section.
 - .2 Distribute material uniformly. Do not broadcast material.
 - .3 During spreading operation, thoroughly loosen and uniformly distribute material by lutes or covered rakes. Reject material that has formed into lumps and does not break down readily.
 - .4 Following placing and before rolling, check surface with templates and straightedges and correct irregularities.
 - .5 Provide heating equipment to keep hand tools free from asphalt. Temperature of tools is not to be higher than temperature of mix being placed.

3.6 Compacting

- .1 Roll asphalt continuously to specified density.
- .2 Provide at least two rollers one of which must be pneumatic-tired type, and as many additional rollers as necessary to achieve specified pavement density.
- .3 Start rolling operations as soon as placed mixture can bear weight of roller without undue displacement of material or cracking of surface.
- .4 Operate roller slowly on first pass to avoid displacement of material. For subsequent rolling do not exceed 5 km/h for steel-wheeled rollers and 8 km/h for pneumatic-tired rollers.
- .5 Overlap successive trips of roller by at least one-half width of roller and vary trip lengths.

- .6 Keep wheels of roller slightly moistened with water to prevent pick-up of material but do not over-water.
- .7 After longitudinal joints and edges have been compacted, start rolling longitudinally at low side and progress to high side.
- .8 Where rolling causes displacement of material, loosen affected areas at once with lutes or shovels and restore to original grade of loose material before re-rolling.
- .9 Do not permit heavy equipment or rollers to stand on finished surface before it has been compacted and has thoroughly cooled.
- .10 When paving in echelon, leave unrolled 50 to 75 mm along edge which second paver is following and roll after second paver has passed when joint between lanes is rolled.

3.7 Joints

.1 General

- .1 Trim to vertical face to provide true surface and cross section against which new pavement may be laid. Remove loose particles.
- .2 Paint joint face with thin coat of hot asphalt cement or preheat joint face with approved heater, prior to placing of fresh mixture.
- .3 Overlap previously laid strip with spreader by 100 mm.
- .4 Remove surplus material from surface of previously laid strip. Do not dispose on surface of freshly laid strip.

.2 Transverse Joints

- .1 Transverse joints between existing pavement and asphaltic concrete pavement placed under this Contract shall be of a vertical butt type, well bonded, sealed, and finished to provide a continuous, smooth profile across the joint. Joint construction is to be as follows:
 - .1 The existing pavement shall be cold milled to expose a vertical surface, of a depth equal to the final lift, against which new pavement may be placed.
 - .2 In longitudinal section, the minimum slope of the milled area shall be 100 horizontal to 1 vertical.
 - .3 In plan, the Contractor shall stagger joints by at least 2 m in adjacent mats.
- .2 When the existing pavement has been removed in advance of paving the joint area, the Contractor shall construct a smooth taper at the joint area to

a slope of at least 20 horizontal to 1 vertical. The taper may be placed on tar paper and shall be removed when paving is resumed. The transverse joint shall be straight and have a vertical face when the taper is removed.

.3 Longitudinal Joints

- .1 Before rolling, carefully remove and discard coarse aggregate in material overlapping joint with a lute or rake. Do not rake or discard aggregate material onto freshly screed surfaces.
- .2 Roll longitudinal joints directly behind paving operation.
- .3 On initial pass, operate roller on previously placed lane such that not more than 150 mm of roller rides on edge of newly laid lane, then operate roller to pinch and press fines gradually across joint. Continue rolling until a thoroughly compacted neat joint is obtained.
- .4 Offset longitudinal joints in succeeding lifts by at least 150 mm.
- .5 On final lift offset longitudinal joints by at least 150 mm from intended lane markings.
- .4 Construct feather joints so that thinner portion of joint contains fine graded material obtained by changed mix design or by raking out coarse aggregate in mix. Place and compact joint so that joint is smooth and without visible breaks in grade.

3.8 Finish Tolerances

- .1 Finished asphalt surface to be within 5 mm of design elevation but not uniformly high or low.
- .2 Finished asphalt surface not to have irregularities exceeding 5 mm when checked with a 3.0 m straight edge placed in any direction.

3.9 Surface Irregularities and Defects

- .1 Correct irregularities which develop before completion of rolling by loosening surface mix and removing or adding material as required. If irregularities or defects remain after final compaction, remove surface course promptly and lay new material to form a true and even surface and compact immediately to the specified density.
- .2 Repair areas showing checking or hairline cracking.

3.10 Pavement Markings

- .1 The Contractor shall arrange to install temporary pavement markings within two hours following placement of first or final lift of pavement as per Section 32 17 23 – Painted Traffic Lines and Markings, where applicable.

- .2 Permanent pavement markings shall be installed within one week following placement of final lift of pavement as per Section 32 17 33 – Thermoplastic Pavement Markings, where applicable.
 - .1 The Contractor to provide 24 hour notice to the Engineer if installation of permanent pavement markings will not occur within the one week time frame.
 - .2 The Engineer shall arrange to have the temporary pavement markings maintained until the permanent pavement markings have been installed.
 - .3 Delay in installation of permanent markings not to exceed 28 working days.

3.11 Traffic Control

- .1 Refer to Section 01 35 14 – Traffic Control.

3.12 Environmental Protection

- .1 Avoid asphaltic concrete entering storm drainage system.

<p align="center">TABLE A ASPHALT MIX TYPES (Refer to Section 31 05 17 - Table A Aggregate Gradation - for gradation specifications)</p>	
MIX TYPE	USE
5a	Thin Levelling Course Skin Patching
5b(1)	Bottom and Top Lift for Local and Collector Roadways Bottom Lift for Arterial Roadways Lane and Parking Lot Paving Trench Repairs
5b(2)	Overlay (crown) Paving Bottom and Top Lift for Local, Collector, and Arterial Roadways
5c	Bottom and Top Lift for Local and Collector Roadways, and Bottom for Arterial Roadways
5d	Top Lift and Overlay for Arterial Roadways
5e	Bottom Lift for Arterial Roadways
Specific areas of use of each class of asphaltic concrete pavement will be defined on drawings and/or unit price table.	

TABLE B
PROPERTIES OF ASPHALT CEMENT FOR ROADS CGSB-16.3

TEST	ASTM TEST METHOD	TEST RESULT
1. Absolute Viscosity at 60° C (Pascals per second)	D 2171	Penetration (150) 78 - 155 (200) 50 - 92
2. Kinematic Viscosity at 135° C (mm ² per second)	D 2170	Penetration (150) 255 - 360 (200) 205 - 285
TABLE B (cont) PROPERTIES OF ASPHALT CEMENT FOR ROADS CGSB-16.3		
3. Penetration at 25° C, 100 gm, 5 second, (dmm)	D5	150 - 200
4. Ductility of residue at 25° C (minimum cm)	D 113	100
5. Solubility in Trichloroethylene (minimum %)	D 2042	99.5
6. Flash Point - Cleveland Open Cup (°C)	D 92	205
7. Test on residue from thin film oven test (D 1754) ratio of absolute viscosity to original absolute viscosity	D 2171	4.0

TABLE C
AGGREGATE VARIATION LIMITS

SIEVE DESIGNATION (MM)	MAXIMUM PERMISSIBLE VARIATION * PERCENT BY WEIGHT PASSING
5.0	± 5
1.25	± 3
0.630	± 2
0.315	± 2
0.160	± 1.5
0.080	± 1.5
*In any case, the Lot Average Gradation must meet the gradation requirements of Section 31 05 17 – Aggregate Materials.	

TABLE D
ASPHALTIC CONCRETE PAVEMENT
MIX TYPES AND CHARACTERISTICS

Aggregate Designation, Section 31 05 17 Table A	5a	5b(1)	5b(2)	5c	5d	5e
Aggregate Size	10	12.5	12.5	16	16	20
% Manufactured Fines, -5000 (Minimum) (See Note 1)	60	60	70	60	70	60
% Fractures, +5000 (2 Faces) (Minimum)	60	70	90	70	90	70
Asphalt Cement Grade	150 - 200A	150 - 200A	150 - 200A	150 - 200A	150 - 200A	150 - 200A
Minimum Marshall Stability, N	5300	8500	10000	8500	10000	6700
Number of Blows	75	75	75	75	75	75
% Air Voids	3 to 5	3 to 5	3 to 5	3 to 5	3 to 5	3 to 5
VMA % (Minimum) by 3% Air Voids	14	13	13	13	13	12.5
VMA % (Minimum) by 4% Air Voids	15	14	14	14	14	13.5
VMA % (Minimum) by 5% Air Voids	16	15	15	15	15	14.5
Minimum Theoretical Asphalt Film Thickness, (Microns) (See Note 3)	7.0	7.0	7.5	7.0	7.5	7.0
Voids filled with Asphalt, %	65 to 78	65 to 75	65 to 75	65 to 75	65 to 75	65 to 75
Flow, mm	2 to 4	2 to 3.5	2 to 3.5	2 to 3.5	2 to 3.5	2 to 3.5
Minimum Retained Stability, %	70	70	70	70	75	70
Note 1: The percentage of Manufactured Fines in the -5000 portion of the Combined Aggregate.						
Note 2: All fines manufactured by the process of crushing shall be incorporated into the mix for Asphalt Mix Type 5a.						
Note 3: The minimum theoretical film thickness value shall be established in accordance with TLT-311.						

TABLE D (cont'd)	
ASPHALTIC CONCRETE PAVEMENT MIX TYPES AND CHARACTERISTICS.	
General Requirements for Mix Design:	
1.	It is recommended that the Design Asphalt Content be determined at 4% air voids, which is the midpoint of the design air voids. The test properties at this asphalt content are then checked to ensure compliance with the respective criteria.
2.	A minimum of four specimens shall be prepared at each asphalt content.
3.	Theoretical maximum specific gravity shall be determined in duplicate for a least three asphalt contents.
4.	Retained stability after 24 hours soaking at 60°C to be run at the recommended Design Asphalt Content.

TABLE E ASPHALTIC CONCRETE PAVEMENT UNIT PRICE REDUCTION FOR PAVEMENT THICKNESS	
Thickness Deficiency (mm)	Payment Reduction Factor
0 to 5	0%
6 to 9	10%
10 to 12	25%
13 to 15	50%
Over 15	Remove and Replace

TABLE F SPECIFIED ASPHALT CONCRETE PAVEMENT DENSITY		
Type of Pavement	Minimum Density	Payment Reduction Factor
Levelling Course	96%	N/A
Crown Paving Locals and Collectors (Mix 5b and 5c)	96%	B
Crown Paving Arterials (Mix 5d)	97%	A
Bottom lift for local, collector, and arterial roadways	96%	B
Top lift for local, collector, and arterial roadways	97%	A
Paved lanes and parking lots	95%	C
Trench Repairs	95%	C

TABLE G
ASPHALTIC CONCRETE PAVEMENT
UNIT PRICE ADJUSTMENT FOR DENSITY

A		B		C	
Specific Density = 97%		Specific Density = 96%		Specific Density = 95%	
Field Density	Payment Reduction Factor (%)	Field Density	Payment Reduction Factor (%)	Field Density	Payment Reduction Factor (%)
97.0 to 96.6	0	96.0 to 95.6	0	95.0 to 94.6	0
96.5 to 96.1	3%	95.5 to 95.1	3%	94.5 to 94.1	4%
96.0 to 95.6	7%	95.0 to 94.6	9%	94.9 to 93.6	12%
95.5 to 95.1	14%	94.5 to 94.1	18%	≤ 93.5	Remove and Replace
95.0 to 94.6	24%	≤ 94.0	Remove and Replace		
≤ 94.5	Remove and Replace				

TABLE H
ASPHALTIC CONCRETE PAVEMENT
UNIT PRICE ADJUSTMENT FOR ASPHALT CONTENT

A. Adjustment for Unit Price Per Tonne

Deviation of the Actual Asphalt Content from the Approved Design Asphalt Content (%)	Unit Price Adjustment for Asphalt Content (\$ per tonne)			
	Top Lift		Bottom Lift(s)	
	Below	Above	Below	Above
Article I. From 0 to 0.30	\$0.00	\$0.00	\$0.00	\$0.00
From 0.31 to 0.40	-\$2.00	-\$1.75	-\$2.00	-\$1.75
From 0.41 to 0.50	-\$4.00	-\$3.50	-\$4.00	-\$3.50
From 0.51 to 0.60			-\$6.00	-\$5.25
From 0.61 to 0.70			-\$8.00	-\$7.00

B. Adjustment for Unit Price Per Square Metre

Deviation of the Actual Asphalt Content from the Approved Design Asphalt Content (%)	Unit Price Adjustment for Asphalt Content (%)			
	Top Lift		Bottom Lift(s)	
	Below	Above	Below	Above
Article II. From 0 to 0.30	0.00%	0.00%	0.00%	0.00%
From 0.31 to 0.40	-4.00%	-3.50%	-4.00%	-3.50%
From 0.41 to 0.50	-8.00%	-7.00%	-8.00%	-7.00%
From 0.51 to 0.60			-12.00%	-10.50%
From 0.61 to 0.70			-16.00%	-14.00%

Notes:

1. For top lift and asphaltic concrete overlay paving deviations of more than 0.60%, the Contractor shall remove and replace the previously laid mix.
2. For bottom lift(s) deviations of more than 0.70%, no payment will be made and the Engineer will determine whether removal and replacement is necessary.

1. GENERAL

This Section specifies requirements for asphalt paving by mixed-in-place methods, combining aggregate and liquid asphalt on-site using motor graders and other road mixing equipment or travel plant mixing equipment.

1.1 Related Work

.1	Traffic Control	Section 01 35 14
.2	Aggregate Materials	Section 31 05 17
.3	Reshaping Granular Roadbed	Section 32 11 13
.4	Asphalt Prime Coat	Section 32 12 14
.5	Pavement Marking General	Section 32 17 13

1.2 Samples

- .1 At least two weeks prior to commencing work, inform the Engineer of proposed source of aggregates and provide access for sampling.
- .2 If requested, submit to the Engineer, one 4-litre container of asphalt material proposed for use in work, at least two weeks prior to commencing operations.

2. PRODUCTS

2.1 Materials

- .1 Liquid asphalt: MC 250.
- .2 Asphaltic concrete aggregate shall be crushed gravel. Gradation to be in accordance with Section 31 05 17 - Aggregate Material, for class of material specified.
- .3 Aggregate sand equivalent to ASTM D2419, minimum 30%.
- .4 Crushed particles of coarse aggregate: at least 50% of particles by mass, to have at least two freshly fractured faces.

2.2 Mix Design

- .1 Job mix formula to be reviewed and approved by the Engineer. Determine initial amount of asphalt by past experience or by empirical formulae.
- .2 Adjust job mix formula as needed, to ensure that asphalt can thoroughly coat aggregate particles. Adjustment subject to approval of the Engineer.

3. EXECUTION

3.1 Equipment

- .1 Road Mix Equipment
 - .1 Have on hand sufficient equipment for mixing, spreading, and rolling mixture.
 - .2 Self-propelled, tandem drive blade machines of approved design capable of satisfactorily mixing and spreading materials.
 - .3 Pulveriser machines or multiple disc equipment so constructed as to prevent cutting of roadway base during mixing.
- .2 Asphalt Distributor
 - 1 Designed, equipped, maintained, and operated so that asphalt material at even heat may be applied uniformly on variable widths of surface up to 5 m at readily determined and controlled rates from 0.3 to 5.5 L/m², with uniform pressure, and with an allowable variation from any specified rate not to exceed 0.1 L/m².
 - .2 Capable of distributing asphalt material in uniform spray without atomization at temperature required.
 - .3 Equipped with meter registering metres of travel per minute visibly located to enable truck driver to maintain constant speed required for application at specified rate.
 - .4 The pump shall operate by separate power unit independent of truck power unit.
 - .5 Equipped with an easily read, accurate, and sensitive device which registers temperature of liquid in reservoir.
 - .6 Equipped with accurate volume measuring device or calibrated tank.
- .3 Compaction Equipment
 - .1 Sufficient number of rollers of type and weight to compact mix to dense uniform mass.

3.2 Preparation of Base

- .1 Prepare base according to one of the following as directed or specified by the Engineer:
 - .1 When existing base requires major scarification and when new aggregate

is to be placed for road mixing, reshape granular roadbed in accordance with Section 32 11 13 – Reshaping Granular Roadbed.

- .2 When existing base is in generally good condition and when new aggregate is to be placed for road mixing, lightly scarify and blade existing base surface to uniform grade and to cross section as indicated. Roll or water and roll as directed. Fill depressions and strengthen weak sections with new aggregate as directed by the Engineer.
- .3 When aggregate is to be salvaged from existing road surface, lightly scarify and blade existing base surface to uniform grade and to cross section indicated. Scarify again reshaped surface to depth as directed by the Engineer, leaving foundation of undisturbed material parallel both in profile and cross section to proposed finished grade. Blade loosened material into windrow at side of road. Compact remaining base material as directed by the Engineer.

3.3 Aggregate Placing

- .1 Obtain Engineer's approval of grade prior to placing aggregate.
- .2 Place aggregate on grade in windrows in quantities sufficient to produce finished course of thickness as indicated. Mix aggregate as required to achieve uniformity and specified gradation requirements.
- .3 If aggregate moisture content exceeds 2%, aerate until moisture content is 2% or less at time of asphalt application.

3.4 Mixing

- .1 Mix liquid asphalt into aggregate as follows:
 - .1 With blade, flatten aggregate windrow sufficiently to allow passage of distributor and apply liquid asphalt material from distributor in successive applications, each application not to exceed 2.7 L/m² until amount required by job mix is attained.
 - .2 Follow with mixing equipment immediately behind distributor and partially mix aggregate and liquid asphalt after each asphalt application.
 - .3 Continue mixing after final liquid asphalt application until aggregate particles are fully coated and mixture is obtained free from fat or lean spots.
- .2 Correct asphalt deficiencies or excesses or uneven distribution by addition of aggregate or liquid asphalt and remixing as required to achieve uniform mix of specified asphalt content.
- .3 Do not apply liquid asphalt to aggregate if air temperature in shade is less than 10° C unless permitted by the Engineer. Suspend liquid asphalt application

during rain.

- .4 Schedule work so that liquid asphalt application, mixing, spreading, and compacting are accomplished in continuous operation.
- .5 Ensure no material is cut from underlying layer or mixing surface and incorporated into mix during mixing operations.

3.5 Aeration and Spreading

- .1 Aerate mix until sufficient volatiles are removed to give compactable mix.
- .2 Spread and blade mixture to uniform layer giving lines and grades as indicated when compacted.
- .3 Compacted lift thickness, maximum 75 mm.

3.6 Compacting

- .1 Compact immediately behind spreading operation by rolling until uniformly textured, tight surface and density satisfactory to the Engineer is achieved.
- .2 Do initial rolling with pneumatic-tired roller and final rolling with steel wheeled roller.
- .3 Blade as necessary during compaction to fill ruts or other irregularities and trim edge neatly to line.

3.7 Tolerances

- .1 Finished mixed-in-place asphalt lift thickness' to be within ± 10 mm of specified thickness' but not uniformly thicker or thinner.
- .2 Correct irregularities exceeding 10 mm when checked with 3 m straight-edge placed in any direction. Correct irregularities by blading while mixture is still soft.

3.8 Remixing

- .1 Remix portions of finished mixed-in-place asphalt surfaces that show evidence of unsatisfactory asphalt content within three weeks of usage of surface by normal traffic. Sections with ravelling require addition of liquid asphalt, while sections with surface lateral displacement require additional mixing and/or additional aggregate.
- .2 Remix by blading asphalt surface into windrows, mixing, adding liquid asphalt or aggregate as required, mixing aerated, spreading and compacting into new finished surface.
- .3 Remixed portions of finished mixed-in-place asphalt surface are subject to further

three week performance evaluation and any necessary remixing.

3.9 Pavement Markings

- .1 The Contractor shall arrange to install temporary pavement markings within two hours following placement of pavement as per Section 32 17 23 - Painted Traffic Lines and Markings.
- .2 Permanent pavement markings shall be installed within one week following placement of pavement as per Section 32 17 33 - Thermoplastic Pavement Markings.
 - .1 The Contractor to provide 24 hour notice to the Engineer if installation of permanent pavement markings will not occur within the one week time frame.
 - .2 The Engineer shall arrange to have the temporary pavement markings maintained until the permanent pavement markings have been installed.
 - .3 Delay in installation of permanent markings not to exceed 28 working days.

3.10 Traffic Control

- .1 Restrict traffic speed to 40 km/hr during curing and setting period sufficiently to prevent surface damage.
- .2 Refer to Section 01 35 14 – Traffic Control, regarding appropriate warning signage.

3.11 Environmental Protection

- .1 Avoid liquid asphalt or blended mixture from entering storm drainage system.

1. GENERAL

This Section specifies requirements for preparing existing road surface for overlay paving and completing overlay paving work.

1.1 Related Work

.1	Cleaning	Section 01 74 11
.2	Cast-in-Place Concrete	Section 03 30 20
.3	Pavement Marking Removal	Section 32 01 12
.4	Routing and Sealing Pavement Cracks	Section 32 01 18
.5	Asphalt Tack Coat	Section 32 12 15
.6	Hot-Mix Asphalt Concrete Paving	Section 32 12 16
.7	Reshaping Asphalt Pavement (Milling)	Section 32 12 53
.8	Removal and Replacement of Concrete Work	Section 32 13 14
.9	Pavement Marking General	Section 32 17 13
.10	Adjustment of Manholes, Catch Basins, Hydrants and Water Valves	Section 33 05 14

2. PRODUCTS

2.1 Materials

- .1 For specifications of the material required for a project, refer to the specific Section (as noted above) of that material.

3. EXECUTION

3.1 Overlay Paving Procedures

- .1 Replace existing concrete at locations shown on Drawing or as designated by the Engineer in accordance with Section 32 13 14 – Removal and Replacement of Concrete Work.
- .2 Concrete work to be constructed to match existing cross section unless shown otherwise on Drawings.
- .3 Complete road repairs adjacent to concrete work as shown on drawings using lean concrete as replacement for granular base as per Section 03 30 20 – Cast-In-Place

Concrete.

- .4 Milling of existing asphalt pavement as shown on drawings and/or as directed by the Engineer in accordance with 32 12 53 – Reshaping Asphalt Pavement (Milling).
- .5 Repair cracks following milling as per Section 32 01 18 – Routing and Sealing Pavement Cracks.
- .6 Coordinate installation of traffic signal detector loops and home run wires with the Engineer.
- .7 Clean pavement surface and remove tailings as per Section 32 01 12 – Pavement Marking Removal.
- .8 Supply and place asphaltic tack coat as per Section 32 12 15 – Asphalt Tack Coat.
- .9 Supply and place asphaltic concrete as show on drawings and/or as directed by the Engineer in accordance Section 32 12 16 – Hot-Mix Asphalt Concrete Paving.

3.2 Pavement Markings

- .1 The Contractor shall arrange to install temporary pavement markings within two hours following placement of pavement as per Section 32 17 23 – Painted Traffic Lines and Markings.
- .2 Permanent pavement markings shall be installed within one week following placement of pavement as per Section 32 17 33 – Thermoplastic Pavement Markings.
 - .1 The Contractor to provide 24 hour notice to the Engineer if installation of permanent pavement markings will not occur within the one week time frame.
 - .2 The Engineer shall arrange to have the temporary pavement markings maintained until the permanent pavement markings have been installed.
 - .3 Delay in installation of permanent markings not to exceed 28 working days.

1. GENERAL

This Section specifies requirements for milling or grinding existing asphalt pavement to lines, grades, and typical cross sections indicated on plans or as established by the Engineer.

1.1 Related Work

- | | | |
|----|--------------------------|------------------|
| .1 | Traffic Control | Section 01 35 14 |
| .2 | Cleaning | Section 01 74 11 |
| .3 | Asphalt Pavement Removal | Section 02 41 14 |

1.2 Protection

- .1 Protect existing pavement, traffic detector loops, home runs, light units, and structures from damages. In event of damage immediately replace or make repairs to approval of the Engineer and at no additional cost to the Owner.

2. EXECUTION

2.1 Preparation

- .1 Inspect site and verify with the Engineer areas designated for milling.
- .2 Arrange for temporary traffic control in areas where signal light traffic detector loops and home runs are to be removed.
- .3 No milling will be permitted in excess of five calendar days prior to pavement rehabilitation being scheduled to be completed. All areas must be clearly marked and signed immediately after milling work is completed.

2.2 Equipment

- .1 Use cold milling or grinding equipment capable of removing part of asphalt pavement surface to depths or grades indicated with a tolerance of ± 10 mm within areas designated.
- .2 Sweeping and collecting equipment capable of removing all residue from operation.
- .3 Apply water as necessary during milling operation to suppress dust.

2.3 Asphalt Removal

- .1 Mill asphalt pavement to grade and cross section dimensions indicated or directed by the Engineer.
- .2 Exercise care to avoid disturbance to pavement or other work designated to

remain.

- .3 Keep drainage system clear of loose and waste materials.
- .4 Asphalt is to be removed to a uniform level including areas surrounding valves, manholes or other appurtenances.
- .5 Remove all residue materials resulting from milling operation.
- .6 No milling is permitted on arterial roads from 7:00 a.m. to 9:00 a.m. nor 4:00 p.m. to 6:00 p.m. on weekdays unless permission is granted by the Engineer.
- .7 Surface to be left in a condition that can be reopened to traffic following removal of grindings.
- .8 Milling will include removal of asphalt around manholes and valves at locations determined by the Engineer. The Contractor is to spray paint manholes and valves to make them visible to motorists.

2.4 Disposal of Material

- .1 Removed pavement material is the property of the Owner and is to be stockpiled at a location designated by the Engineer.

2.5 Finish Tolerances

- .1 Milled surface to be within ± 10 mm of specified grade but not uniformly high or low.

1. GENERAL

This Section specifies the requirements for the removal and replacement of Portland Cement concrete and concrete paving stone work; including

- Monolithic curb, gutter, and sidewalk
- Separate sidewalk
- Curb and gutter
- Curb on asphalt base
- Curb ramps
- Concrete cap medians and traffic islands
- Monolithic slab medians and traffic islands on asphalt base
- Reinforced lane and driveway crossings
- Swales
- Combined concrete/paving stone sidewalks
- Combined concrete/paving stone lane crossings
- Miscellaneous concrete work

1.1 Related Work

.1	Site Demolition	Section 02 41 43
.2	Basic Concrete Materials and Test Methods	Section 03 05 13
.3	Slip Formed Concrete	Section 03 12 10
.4	Concrete Reinforcement	Section 03 20 10
.5	Cast-in-Place Concrete	Section 03 30 20
.6	Aggregate Materials	Section 31 05 17
.7	Roadway Embankment and Compaction	Section 31 24 13
.8	Concrete Work	Section 32 13 15
.9	Precast Paving Stone	Section 32 14 20
.10	Topsoil and Finish Grading	Section 32 91 21
.11	Sodding	Section 32 92 23
.12	Construction Specification Drawings	Division 50

1.2 Definitions

- .1 Handformed Concrete Work means the conventional method of construction using forms.
- .2 Extruded Concrete means construction of concrete work using slip form paving machines.
- .3 Sidewalk Flagging means the removal and replacement of the sidewalk section of a monolithic curb, gutter, and sidewalk cross section by saw cutting along the back of curb surface joint and removing the sidewalk panel.
- .4 Curb Flagging means the removal and replacement of the curb and gutter of a monolithic curb, gutter, and sidewalk cross section by sawcutting along the back of the curb surface joint and removing the curb and gutter and installing dowel pins into the sidewalk.

1.3 Concrete Work Dimensions

The existing concrete work, in particular 1.5 m monolithic curb, gutter, and sidewalk may vary in width from the current cross section by 150 mm, plus or minus. The Contractor is to construct the new concrete work to the original dimensions or to the cross sections as specified by the Engineer.

2. PRODUCTS

2.1 General

- .1 Concrete paving stone products to Section 32 14 20 – Precast Paving Stone.
- .2 Topsoil to Section 32 91 21 – Topsoil and Finish Grading.
- .3 Sod to Section 32 92 23 – Sodding.
- .4 Reinforcing steel to Section 03 20 10 – Concrete Reinforcement.
- .5 Plastic Sleeves: 250 mm long section of PVC pipe; diameter to suit standpipe and valve box O.D.

3. EXECUTION

3.1 Saw cutting, Removal and Disposal

- .1 Saw cutting, removal and disposal of concrete work and/or asphalt to Section 02 41 43 – Site Demolition.
- .2 In some areas of concrete removal and replacement, the existing streetlight duct is located immediately under the concrete work and encased in the concrete work. The Contractor shall have all electrical work located before proceeding with

concrete removals. Responsibility for repair of damaged electrical duct/cable is to be as follows:

- .1 If the duct/cable is encased in the concrete work, the Owner shall be responsible for repair costs.
- .2 If the duct/cable is located below the concrete, the Contractor shall be responsible for repair costs.
- .3 The Contractor shall be responsible for coordination of power shut-off prior to concrete work removal and for reconnection or all damaged underground wires.

3.2 Sub-grade Preparation

- .1 Subgrade preparation to Section 31 24 13 – Roadway Embankment and Compaction.
- .2 Removal and replacement of unsuitable subgrade to be approved by the Engineer prior to work proceeding. Depth of excavation to be identified at the job site(s).
- .3 Remove unsuitable subgrade material and place clean fill sand, crushed gravel or native backfill material, as approved by the Engineer, to 97% Standard Proctor Density.
- .4 Supply, place and compact crushed gravel.

3.3 Replace Existing Concrete Work With New Concrete Work

- .1 Saw cut existing concrete work (monolithic sidewalk, curb and gutter, or separate sidewalk at an existing longitudinal surface joint).
- .2 Remove existing concrete work without disturbing concrete work that is to remain.
- .3 Reconstruct or adjust base as directed by the Engineer.
- .4 Drill and install dowels as shown in the Division 50 drawings.
- .5 Place PVC sleeve and reinforcing steel around valve boxes as shown in Division 50 – Construction Specification Drawings, at locations as directed by the Engineer.
- .6 New concrete work to Section 32 13 15 - Concrete Work.

3.4 Separate Sidewalk Dowelled to Existing Curb and Gutter

- .1 Supply and place 10 m dowels at 500 mm O.C. as shown on the Division 50 drawings.

- .2 New concrete work to Section 32 13 15 Concrete Work.

3.5 Sidewalk Flagging

- .1 Saw cut monolithic sidewalk along the back of curb surface joint.
- .2 Remove sidewalk section without disturbing curb and gutter section.
- .3 Drill and install dowels as shown in the Division 50 drawings.
- .4 Reconstruct or adjust base as directed by the Engineer.
- .5 New concrete work to Section 32 13 15 - Concrete Work.

3.6 Curb Flagging

- .1 Saw cut monolithic curb along the back of curb surface joint.
- .2 Saw cut asphalt.
- .3 Remove curb and gutter section without disturbing sidewalk section.
- .4 Drill and install dowels as shown in the Division 50 drawings.
- .5 Reconstruct or adjust base as directed by the Engineer.
- .6 New concrete work to Section 32 13 15 – Concrete Work.

3.7 New Paving Stone Work

- .1 New paving stone work to Section 32 14 20 – Precast Paving Stone.

3.8 Repair of Existing Paving Stone Work

- .1 Remove and stockpile existing paving stone.
- .2 Replace edge restraint where required by the Engineer.
- .3 Place additional sand levelling course material where required.
- .4 Complete paving stone installation to Section 32 14 20 – Precast Paving Stone.
Replace damaged paving stone with new material.

3.9 Lane and Driveway Crossings

- .1 Saw cut existing concrete work at an existing longitudinal contraction joint.
- .2 Remove existing concrete work without disturbing concrete work that is to

remain.

- .3 Reconstruct or adjust base as directed by the Engineer.
- .4 Drill and install dowels as shown in Division 50 drawings.
- .5 Install reinforcing steel as shown in Division 50 drawings.
- .6 New concrete work to Section 32 13 15 – Concrete Work.

3.10 Marking Concrete Work

- .1 Mark new concrete work to Section 32 13 15 – Concrete Work.

3.11 Adjustment to Manholes, Catch Basins, Valve Boxes, Standpipes, and Fire Hydrants

- .1 The Contractor shall complete minor adjustments (± 100 mm) of manholes and catch basins. Adjustment shall consist of locating, raising or lowering catch basins and manholes to suit the finished pavement or concrete elevation as shown on the Drawings or as directed by the Engineer. Adjustments greater than 100 mm or reconstruction of manholes and catch basins to be completed by others.
- .2 A cement mortar bond shall be used to repair storm manholes, sanitary manholes, and catch basins which are required to be reset. Each joint shall be made water tight with an approved cement mortar. All surplus mortar shall be cleaned from the interior surface of each unit as work progresses.
- .3 The Contractor will be responsible for all adjustments to fire hydrants, water valve boxes, and standpipes.
- .4 The Contractor shall place a plastic sleeve around all valves and standpipes prior to concrete being completed.
- .5 The Contractor shall give the Town one week prior notice, by form of a schedule, indicating when adjustments to water valves and manholes are required by. Twenty-four hours immediately prior to the adjustments by the Town of Sylvan Lake, the Contractor shall accept the manholes and water valves in the raised position and also accept all related responsibilities associated with barricading them and making them safe to the public, etc., or until asphalt paving is completed.

3.12 Backfill

- .1 Allow concrete to cure for seven days prior to backfilling.
- .2 Removal all construction debris.
- .3 Backfill to 150 mm below existing elevations with suitable material approved by

the Engineer, compact 95% Standard Proctor Density and shape to required contours within the disturbed area so landscaping repairs can be done.

- .4 When concrete repairs require removal of asphalt behind the curb or sidewalk, backfill must be with lean concrete slurry mix to match the underside elevation of the existing asphalt or to a maximum depth of 75 mm below lip of gutter. Asphalt repairs are to be completed by others.

3.13 Road Asphalt Repairs

- .1 Where concrete removal and replacement has required the removal of asphaltic concrete material and after seven days curing time and the forms have been removed, the Contractor will:
 - .1 Level and compact existing base course gravel.
 - .2 Backfill area with lean concrete slurry mix to match underside of existing asphalt or to a maximum depth of 75 mm below lip of gutter or back of walk.

4. LANDSCAPING REPAIRS

4.1 Topsoil

- .1 Supply and place topsoil to Section 32 91 21 – Topsoil and Finish Grading.
- .2 Topsoil to be obtained from the Town of Sylvan Lake stockpiles within the Town limits.
- .3 Topsoil placement to be done within 7 days after sidewalk repair is complete.

4.2 Sod

- .1 Supply and place sod to Section 32 92 23 – Sodding.
- .2 Sod to be placed within 15 days after the sidewalk repair is completed.

1. GENERAL

This Section specifies requirements for Portland cement concrete works, including:

- .1 Monolithic curb, gutter, and sidewalk
- .2 Separate sidewalk
- .3 Curb and gutter
- .4 Curb on asphalt base
- .5 Curb ramps
- .6 Concrete cap medians and traffic islands
- .7 Monolithic slab medians and traffic islands on asphalt base
- .8 Reinforced lane and driveway crossings
- .9 Swales
- .10 Stamped Concrete
- .11 Miscellaneous concrete work shown on the drawing and/or listed in the Schedule of Quantities.

1.1 Related Work

- | | | |
|-----|---|------------------|
| .1 | Site Demolition | Section 02 41 43 |
| .2 | Basic Concrete Materials and Test Methods | Section 03 05 13 |
| .3 | Concrete Formwork | Section 03 10 00 |
| .4 | Slip Formed Concrete | Section 03 12 10 |
| .5 | Concrete Reinforcement | Section 03 20 10 |
| .6 | Cast-in-Place Concrete | Section 03 30 20 |
| .7 | Aggregate Materials | Section 31 05 17 |
| .8 | Roadway Embankment and Compaction | Section 31 24 13 |
| .9 | Granular Sub-Base | Section 32 11 19 |
| .10 | Granular Base | Section 32 11 23 |

- .11 Construction Specification Drawings Division 50

1.2 Definitions

- .1 Hand formed Concrete Work: Conventional method of construction using forms.
- .2 Extruded Concrete: Construction of concrete work using slip-form paving machines.

2. PRODUCTS

2.1 Material

- .1 Concrete to Section 03 05 13 – Basic Concrete Materials and Test Methods.
- .2 Reinforcing steel and welded wire to Section 03 20 10 – Concrete Reinforcement.
- .3 Joint filler to ASTM D1751 (AASHTO M213) 20 mm preformed, non-extruding, resilient, bituminous type or approved alternates.
- .4 Curing compound to ASTM C309 with fugitive dye or plastic film to ASTM C171. Curing compound not to be applied where frost is expected within 14 days.
- .5 Sealing solution: 50% boiled linseed oil and 50% kerosene or other sealant approved by the Engineer.
- .6 Form release agent: non-staining mineral type, as per Section 03 10 00 – Concrete Formwork.
- .7 Clean sand aggregate to Section 31 05 17 – Aggregate Materials.

3. EXECUTION

3.1 Subgrade Preparation

- .1 Subgrade preparation for concrete work to Section 31 24 13 – Roadway Embankment and Compaction.
- .2 Supply, install, and compact clean sand or 20 mm base course gravel to 100% Standard Proctor Density, beneath hand-formed sections of concrete work.

3.2 Forming

- .1 Slip forming to Section 03 12 10 – Slip Formed Concrete.
- .2 Hand-forming as per Section 03 10 00 – Concrete Formwork.

3.3 Reinforcing Steel

- .1 Place steel as per Section 03 20 10 – Concrete Reinforcement, and Construction Specification Drawings as per Division 50.
- .2 Make overlaps 500 mm minimum where continuous reinforcement is required.
- .3 Make laps 300 mm minimum width, where required, for wire mesh.

3.4 Concrete

- .1 Concrete placement as per Section 03 30 20 – Cast-In-Place Concrete, and CAN3-A23.1.
- .2 Finish exposed surfaces to a smooth uniform finish, free of open texturing and exposed aggregate. Do not work more mortar to surface than required. Do not use neat cement as a drier to facilitate finishing.
- .3 Broom finish surface to provide non-skid texture.
- .4 Round edges, including edges of joints, with 10 mm radius edging tool.
- .5 Finish surfaces to within 5 mm in 3 m from line, level or grade as measured with a straight edge placed on surface.
- .6 Seal all concrete as follows:
 - .1 Apply with spray method only, two coats of sealing solution.
 - .2 Ensure concrete surfaces are dry, free of dirt or dust, before applying coating.
 - .3 Apply each coat at a rate of 0.1 L/m.
 - .4 Dry first coat thoroughly before applying second coat.
 - .5 Protect adjacent surfaces from spray.
- .7 Transition from straight faced to rolled curb sections to be done gradually over a 3 m length of curb.

3.5 Marking Concrete Work

- .1 The Contractor shall mark the sidewalk and/or curb and gutter with a suitable marking tool approved by the Engineer, showing the name of the Contractor and the year of construction. The letters and numbers of the marking tool shall be 40 mm high.
- .2 Marks shall be placed at the end of curve of each corner of the block, i.e. there shall be a minimum of eight marks per block. If the construction begins or

terminates within the middle of the block, the Contractor shall also mark these locations, or as directed by the Engineer. In addition, a similar mark shall be embossed on the corner of each lane crossing and driveway crossing.

- .3 The Contractor shall mark all reinforced concrete work with a "R" adjacent to the Contractor's stamp at the beginning and end of all reinforced concrete work.
- .4 The Contractor shall mark all dowelled concrete work with a "D" adjacent to the Contractor's stamp at the beginning and end of all dowelled concrete work and at intervals specified by the Engineer.

3.6 Expansion and Contraction Joints

- .1 Install contraction joints at 1.5 m spacing. Contraction joints shall be not less than 30 mm deep, 6 mm in width, and in monolithic sidewalk, curb and gutter, shall extend through the full width of sidewalk, curb and gutter.
- .2 When sidewalk is adjacent to curb, make joints coincide.
- .3 Install isolation joints in concrete around manholes, valve boxes, poles, hydrants, etc. and along length of concrete adjacent to concrete curb, building, or permanent structure.
- .4 Install construction joints at end of all reinforced sections. On sidewalks 2.0 m or greater in width, saw cut a 25 mm deep groove along the centre line of the sidewalk within 12 hours after placing concrete.

3.7 Backfill

- .1 Allow concrete to cure for seven days prior to backfilling. Refer to Section 32 13 14 – Removal and Replacement of Concrete Work.
- .2 Backfill to designated elevations with suitable material, compact to 95% of Standard Proctor and shape to required contours as indicated or directed by the Engineer.
- .3 Backfill within 1 m of back of concrete is incidental to work done under this Section. Any additional work required beyond this limit will be paid for under the appropriate classification as specified in Section 31 24 13 – Roadway Embankment and Compaction.

1. GENERAL

This Section specifies requirements for constructing sidewalks, medians, paraplegic, crosswalks, driveways, and lane crossings using concrete paving stone.

1.1 Related Work

.1	Site Work Demolition	Section 02 41 43
.2	Roadway Embankment and Compaction	Section 31 24 13
.3	Aggregate Materials	Section 31 05 17
.4	Granular Base	Section 32 11 23
.5	Concrete Work	Section 32 13 15
.6	Construction Specification Drawings	Division 50

2. PRODUCTS

2.1 Material

- .1 Granular base to be 20 mm crushed gravel. Gradation to be in accordance with Section 31 05 17 – Aggregate Materials.
- .2 Clean sand for levelling course to Section 31 05 17 – Aggregate Materials.
- .3 Concrete paving stone:
 - .1 Manufactured in conformance with ASTM C936.
 - .2 Thickness
 - .1 Sidewalk and paraplegic ramp concrete paving stone: 60 mm.
 - .2 Crosswalk, driveway, and lane crossing concrete paving stones: 80 mm.
 - .3 Colour: standard red unless otherwise noted on Drawings.
- .4 Physical properties:
 - .1 Compressive strength: minimum average 55 MPa with no individual unit less than 50 MPa.
 - .2 Absorption: maximum average 5% with no individual unit greater than 7%.

- .3 Durability:
 - .1 Freeze-thaw: to ASTM C67,
 - .2 Abrasion resistance: to ASTM C414.
- .5 Permissible variation in dimensions:
 - .1 Length or width: 1.5 mm.
 - .2 Thickness: 3 mm.
- .6 Edge Restraint:
 - .1 Pressure treated lumber, concrete strip, or preformed PVC edging as indicated on Drawings or approved by the Engineer.

3. EXECUTION

3.1 Subgrade Preparation

- .1 Prepare subgrade for concrete work and brick pavers to Section 31 24 13 – Roadway Embankment and Compaction.

3.2 Granular Base

- .1 Subgrade to be approved before placement of granular base.
- .2 Place 100 mm lift granular base to Section 32 11 23 – Granular Base.

3.3 Edge Restraint

- .1 In areas not restrained by existing concrete work, place specified edge restraint material as shown on Drawings.

3.4 Sand Levelling Course

- .1 Granular base to be approved before placement of sand course.
- .2 Place and screed a 25 mm compacted thickness of sand levelling course over area to be paved.
- .3 Once screened and levelled, do not disturb sand levelling course.

3.5 Concrete Paving Stone

- .1 Paving stones shall be laid in approved pattern.
- .2 Joints between stones not to exceed 3 mm.

- .3 Gaps at edge of paved surface shall be filled with standard edge pieces or with stones cut to fit. Stones shall be cut to a straight even surface without cracks or chips.
- .4 Paving stones shall be vibrated to their final level by at least two passes of a vibrating plate compactor.
- .5 After vibration, sand containing at least 30% - 3 mm particles shall be brushed over surface and vibrated into joints with additional passes of plate vibrator so as to completely fill joints.
- .6 Surplus material shall then be swept from surface and disposed of. Avoid material from entering storm drainage system.

3.6 Tolerance

- .1 After final vibrating surface shall be true to grade and shall not vary by more than 8 mm when tested with a 3 m board at any location on surface.

1. GENERAL

This Section specifies the general requirements for pavement markings regardless of the type of pavement marking used. Deviations from these general requirements will be covered in the specific requirements for each material.

The Work shall consist of furnishing all materials, equipment and labour necessary for the required pavement preparation and application of uniformly retro reflective pavement marking materials in accordance with the plans or as described herein. All pavement markings shall conform to the Manual of Uniform Traffic Control Devices for Canada (Current Edition).

1.1 Related Work

.1	Traffic Control	Section 01 35 14
.2	Temporary Construction Signing	Section 01 58 99
.3	Cleaning	Section 01 74 11
.4	Pavement Marking Removal	Section 32 01 12
.5	Painted Traffic Lines and Markings	Section 32 17 23
.6	Thermoplastic Pavement Markings	Section 32 17 33

1.2 References

- .1 ASTM D4060: Test Method for Abrasion Resistance of Organic Coating by Taber Abrasion.
- .2 ASTM D256: Test Method for Impact Resistance of Plastics and Electrical Insulating Materials.
- .3 ASTM D570: Test Method for Water Absorption of Plastics.
- .4 ASTM E28: Test Method for Softening Point by Ring and Ball Apparatus.
- .5 ASTM E1347: Test Method for Directional Reflectance, 45° 0°, of Opaque Specimens by Broadband Filter Reflectometry.

1.3 Definitions

- .1 **Plastic pavement marking material:** means any type of paving marking material, excluding paint, consisting of various materials that harden and retain their shape after being applied to the pavement or concrete surface.

2. PRODUCTS

2.1 Materials

- .1 New marking materials shall be a formulation, as identified by a manufacturer's code number and have the same composition as the prequalified marking material.
- .2 Pavement marking materials for Painted Traffic Lines and Markings shall conform to Section 32 17 23 – Painted Traffic Lines and Markings.
- .3 Pavement marking materials for Thermoplastic Pavement Marking shall conform to Section 32 17 33 – Thermoplastic Pavement Markings.
- .4 A material safety data sheet for each material, including resin, catalyst, activator, glass beads and cleaning solvent to be used on the project shall be furnished by the Contractor to the Engineer prior to the start of work.

- .5 Glass beads: Overlay type: to CGSB1-GP-74M as follows:

- .1 Imperfections: surface of spheres shall be smooth and free from film, scratches and pits. At least 90% shall be of true spherical shape, and free from milkiness, dark or air inclusions and other defects.
- .2 Index of Refraction: liquid immersion method at 25° C may be used to determine refraction index of glass spheres. A refractive index of 1.50 to 1.60 is required.
- .3 Gradation: spheres shall meet following gradation requirements when tested in accordance with ASTM D-1214.

- .1 Spheres included in manufacture of thermoplastic material:

<u>Sieve Size (Microns)</u>	<u>% Passing</u>
250	80 - 100
100	0 - 10

- .2 Spheres for application on molten thermoplastic material:

<u>Sieve Size (Microns)</u>	<u>% Passing</u>
850	90 - 100
300	20 - 50
180	0 - 10

- .4 Beads shall show resistance to corrosion after exposure to a 1% solution (by weight) of sulphuric acid.
- .6 The Contractor or application sub-contractor shall maintain current material safety data sheets for all materials present with this work in an immediately accessible

location.

2.2 Criteria For Acceptance

- .1 Plastic pavement marking materials shall be acceptable for installation on The Town of Sylvan Lake roadways based on the following criteria:
 - .1 The Contractor/Supplier has installed that particular product in other Towns with similar climatic conditions as The Town of Sylvan Lake.
 - .2 The material was installed on roadways with more than 10,000 vehicles per day and over 90% of the marking material remained in good condition after three (3) years of service.
 - .3 The Contractor has provided three references for the product's past performance.
- .2 The Contractor shall submit the requested information for the Town's assessment of a product at least three (3) months prior to bidding on any roadway project in The Town.
- .3 Plastic pavement marking material that does not meet the above noted criteria may be considered for installation at locations specified by The Town for evaluation purposes. The material will be considered an acceptable product if 90% of the markings remain in good condition after three (3) years of service.

3. EXECUTION

3.1 Drawing Confirmation

- .1 Arrange a meeting with the Engineer to review the pavement marking drawings prior to the commencement of pre-marking.

3.2 General

- .1 Lines shall be applied as solid, dashed or dotted stripes, either singly or in combination, as shown on the Drawings.
- .2 Width of line applied shall be the width specified as per Table 'A' appended to this section.
- .3 The Contractor shall use an accurate dashing mechanism, which is capable of being easily adjusted to retrace existing dashed markings or to apply new materials at the correct spacing.
- .4 New dashed lines that are to be applied over plainly visible existing dashed lines shall begin within 150 mm of the beginning of the existing dash, unless otherwise directed by the Engineer.

- .5 Lines and Symbols shall be sharp, well defined and uniformly reflective to provide proper visibility.
- .6 Methods and equipment used for pavement preparation, marking and marking removal shall be subject to the approval of the Engineer.
- .7 The Contractor shall furnish to the Engineer copies of current manufacturer's instructions and recommendations for application of any marking material, including primer, activator, catalyst and/or adhesive called for in the plans.
- .8 Other construction Work such as shoulder paving, seeding and/or mulching shall be scheduled and performed in a manner to avoid damage to applied pavement marking.
- .9 Store pavement marking materials as per manufacture's instructions. Glass beads shall be dry prior to use.

3.3 Site Preparation

- .1 Provide adequate warning signage and vehicular and pedestrian traffic flow as per Sections 01 35 14 – Traffic Control and 01 58 99 – Temporary Construction Signing; and/or as directed by the Engineer.
- .2 Clean and dry pavement surface as per Section 01 74 11 – Cleaning.
- .3 If required, remove existing markings and repair pavement surface as per Section 32 01 12 – Pavement Marking Removal.
- .4 Pre-mark intended lines and symbols.
 - .1 Lines to be pre-marked at a minimum off-set of 150 mm.
 - .2 Symbols to be pre-marked by outline.
 - .3 All markings shall be within 12 mm of location as specified on construction drawings.
 - .4 The Engineer is to inspect and approve pre-markings and variances thereof.
 - .5 Any correction to pre-marking shall be at the Contractor's expense.

3.4 Installation

- .1 Paint application as per Section 32 17 23 – Painted Traffic Lines and Markings.
- .2 Hot thermoplastic application as per Section 32 17 33 – Thermoplastic Pavement Markings.

3.5 Protection and Cleanup

- .1 Do not permit traffic over applied markings until directed by the Engineer.
- .2 Protect surrounding areas and structures from disfiguration and damage. Repair of damage shall be at the Contractor's expense.
- .3 Upon completion of Work site to be left free of debris and waste matter as per Section 01 74 11 – Cleaning.

3.6 Workmanship

- .1 Markings that are or have: insufficient material quantity, excessive overspray, non-uniform application, non-straight edges, are located improperly or have poor reflective quality are not acceptable.
- .2 Faulty markings shall be redone within five working days at no cost to the Owner.
- .3 Removal of pavement markings due to deficit items (as listed previously or as directed by the Engineer) or obsolete marking(s) due to new roadway geometry, to be removed as per Section 32 01 12 -Pavement Marking Removal.
- .4 Removal processes that are not approved include: painting or blacking out the marking and/or leaving the marking to wear out over time.
- .5 Markings that are deemed un-acceptable and are to be removed and replaced will be done so at the Contractor's expense, including furnishings of approved materials.

3.7 Performance Life/Acceptance

- .1 General
 - .1 A warranty period is not applicable for Painted Pavement Markings.
 - .2 Plastic pavement markings shall be warranted against failure due to:
 - .1 Poor adhesion.
 - .2 Defective materials.
 - .3 Improper installation.
- .2 Initial Acceptance of Plastic Pavement Markings

All plastic pavement markings shall have the following initial acceptance requirements:

 - 1 Following initial completion of all pavement marking, there will be a 180 day observation period before initial acceptance. During the observation period, the Contractor, at no additional cost to the Owner, shall replace

markings that the Engineer determines are not performing satisfactorily due to defective materials, workmanship, in manufacture or application. At the end of the observation period, the minimum required retention percentage, by area, for markings installed will be 95 percent.

- .2 Determination of Percentage Retained: The percentage retained shall be calculated as the nominal area of the strip less the area of loss divided by the nominal area and expressed as a percentage of the nominal area.
- .3 The Contractor shall be notified, in writing, within 30 calendar days after the 180 day observation period if there is a failure to achieve the required percentage retained.

When such a notification is made prior to September 1, the replacement material shall be installed during the same construction season. Replacement materials for any notification after September 1 shall be installed prior to June 1 of the following year.

- .4 Initial Acceptance: Initial acceptance of the pavement marking will be:
 - .1 180 days after the initial completion of all pavement marking work, or
 - .2 Upon completion of all corrective work, whichever occurs last.

The Engineer will issue a Construction Completion Certificate for Plastic Pavement Marking once the Initial Acceptance criteria are met.

.3 Final Acceptance/Warranty Period

- .1 The warranty period for plastic pavement markings shall be five years, commencing on issuance of the Construction Completion Certificate for Plastic Pavement Marking.
- .2 During the warranty period, the Contractor, at no additional cost to the Owner, shall replace markings that the Engineer determines are not performing satisfactorily due to defective materials, workmanship, in manufacture or application. During the warranty period, the minimum required retention percentage, by area, for markings installed will be as follows:
 - .1 Year One: 100%
 - .2 Year Two: 95%
 - .3 Year Three: 90%
 - .4 Year Four: 85%
 - .5 Year Five: 80%

The percentage retained will be calculated as specified in Clause 3.7.2.2

- 3 The Contractor shall also guarantee that in all instances there shall be sufficient material remaining at end of the designated warranty period so that pre-marking is not necessary.

TABLE 'A'
LINE DIMENSIONS

Line Type	Colour	Size	Pattern
Centre Line	Yellow	100 mm	Continuous line; break at intersections
Lane Line	White	100 mm	3.0 m line, 6.0 m skip
Continuity Lines	White	100 mm	3.0 m line, 3.0 m skip
Edge Line	White	100 mm	Continuous line
Intersection Guide Lines	White or Yellow	100 mm	0.5 m line, 0.5 m skip; colour as specified on Drawings
Stop Bars	White	300 mm	1.0 m separation from crosswalk; otherwise 4.5 m back of F.O.C. extension
Crosswalk	White	200 mm	2 parallel lines; 2.5 m apart
Arrow symbols	White	-----	Arrow style and size to conform to MUTCD – Figure C1-3
Other symbols	White	-----	Symbol dimensions to conform to MUTCD

TABLE 'B'
MATERIAL TYPE per ROAD CLASSIFICATION

Item	Type of Material
Expressways and Arterial Roadways ¹	
1. Centre Lines	Type 1
2. Edge Lines	Type 1
3. Lane Lines	Type 1
4. Stop Bars	Type 1
5. Crosswalk Lines	Type 1
6. Guide Lines	Type 1
7. Arrows and Symbols	Type 1
8. Concrete Bridge Decks	Paint
9. Asphalt Bridge Decks	Type 1
Collector Roadways	
1. Centre Lines	Type 1
2. Lane Lines	Type 1
3. Stop Bars	Type 1
TABLE B (cont'd)	
4. Crosswalk Lines	Type 1
Local Roadways	
1. Centre Lines	Paint
1. Stop Bars	Paint
2. Crosswalk Lines	Paint

Notes:

- .1 Expressway and Arterial roadways include any portion of a Collector or Local roadway within 50 m of an intersecting expressway or arterial roadway.
- .2 Type 1 - Thermoplastic "Hot In-Laid" material as specified in Section 32 17 33 – Thermoplastic Pavement Markings.

1. GENERAL

This Section specifies requirements for painted pavement markings.

1.1 Related Work

.1	Traffic Control	Section 01 35 14
.2	Cleaning	Section 01 74 11
.3	Pavement Marking Removal	Section 32 01 12
.4	Pavement Marking: General	Section 32 17 13

2. PRODUCTS

2.1 Materials

- .1 Paint
 - .1 Alkyd traffic paint to CGSB 1-GP-74M.
 - .2 Alkyd reflectorized traffic paint to CGSB 1-GP-149M.
 - .3 Colour to CGSB 1-GP-12C
 - .4 White 513-301
 - .5 Yellow 505-308
 - .6 Thinner to CAN/CGSB-1.5.
 - .7 Glass beads to Section 32 17 13 – Pavement Marking: General.

3. EXECUTION

3.1 Equipment Requirements

- .1 Paint applicator to be an approved pressure type mobile distributor capable of applying paint in single, double, and dashed lines. Applicator to be capable of applying marking components uniformly, at rates specified, and to dimensions as indicated, and to have positive shut-off.
- .2 Thoroughly clean distributor tank before refilling with paint of different colour.

3.2 Site Preparation

- .1 Refer to Section 32 17 13 – Pavement Marking: General.

3.3 Application

- .1 Pavement markings to be laid out by the Contractor and layout approved by the Engineer or designate prior to application of paint.
- .2 Unless otherwise approved by the Engineer apply paint only when air temperature is above 10° C and no rain is forecast.
- .3 Apply traffic paint evenly at a rate of 0.33 l/m². The first application of paint to new asphalt pavement surfaces shall be increased by 25% over the specified rate.
- .4 Do not thin paint unless approved by the Engineer.
- .5 Symbols and letters to conform to dimensions indicated on the drawings or in the Manual of Uniform Traffic Control Devices.
- .6 Paint lines must be of uniform colour and density with sharp edges.
- .7 If specified, apply glass beads at a rate of 100 gm/m² of painted area. The glass beads shall be applied to the wet paint so that the beads are embedded and retained in the paint and uniformly cover the painted surface.

3.4 Tolerance

- .1 Paint markings to be within 12 mm of dimensions specified.

3.5 Traffic Control

- .1 Provide adequate warning signs and traffic channelization devices as per Section 01 35 14 – Traffic Control.
- .2 Protect pavement markings until dry.

1. GENERAL

This Section specifies requirements for supply and installation of thermoplastic marking on pavement.

1.1 Related Work

.1	Traffic Control	Section 01 35 14
.2	Cleaning	Section 01 74 11
.3	Asphalt Pavement Removal	Section 02 41 14
.4	Pavement Marking Removal	Section 32 01 12
.5	Pavement Marking: General	Section 32 17 13

1.2 Plastic Pavement Marking Subcontractor Qualifications

- .1 As specified in Section 32 17 13 – Pavement Marking: General

2. PRODUCTS

2.1 Materials

- .1 Thermoplastic pavement marking: hot-extruded, having a specific gravity of 2.0 minimum at 25° C, having a softening point of 90° C minimum according to ASTM E28, and conforming to the following:
 - .1 Water Absorption: 0.5% maximum by mass retained water after 24-hour immersion, according to ASTM D-570 Procedure A.
 - .2 Impact Resistance: Minimum 1.13 J at 25° C when material is cast into a bar 25 mm² cross-section by 75 mm long, with 25 mm extended above vice jaws in a cantilever beam (Izod type) tester using the 2.82 J scale, according to ASTM D-256 Method C.
 - .3 Abrasion Resistance: Maximum weight loss of 0.6 grams when subjected to 200 revolutions on a Taber Abrader at 25° C using H-22 Calibrate wheels weighted to 500 grams with test sample kept wet during test with distilled water. Prepare test sample with representative material placed on 100 mm square plate, 3±0.1 mm thick.
 - .4 Chemical resistance to anti-freeze, brake fluid, motor oil, diesel fuel, gasoline, calcium chloride, sodium chloride, transmission fluid or other de-icing chemicals.
 - .5 Reheating: The thermoplastic compound shall maintain proper performance properties when heated 4 times to the application

temperature. After heating to 800° C for 6 hours while continually stirring at 50 to 100 RPM, the Brookfield viscosity shall not exceed 16,000 cps at 12 RPM.

- .6 No deterioration when in direct contact with asphalt cement in asphaltic concrete materials, or with sodium chloride, calcium chloride or other de-icing chemicals.
- .7 Non – toxic and not harmful to persons or property when in hardened state.
- .8 No discoloration from sunlight ultraviolet exposure and no bond failure for the warranted life of the material.
- .9 In the plastic state, the material shall not give off fumes that are toxic or otherwise injurious to persons or property.
- .10 Acceptable Products:
 - .1 Lafrentz System 300 or approved equivalent.
- .2 Glass Beads as per Section 32 17 13 - Pavement Marking: General.
- .3 Pre-marking Paint: As approved by the Engineer.
- .4 Groove Filler: to Section 02 41 14 – Asphalt Pavement Removal.

2.2 Mix Formulation

- .1 White Colour: Conforming to U.S. Federal Standard 595B Colour Number 37925, 70% minimum when measured with the Colour Guide Reflectometer 0,45° daylight luminous directional reflectance, with a green filter.
- .2 Yellow Colour: Conforming to U.S. Federal Standard 595B Colour Number 33538, 40% minimum when measured with the Colour Guide Reflectometer 0,45° daylight luminous directional reflectance, with a green filter.
- .3 No formulation change unless approved by the Engineer. Any significant change will be subject to field trials.

2.3 Equipment

- .1 Grooving Machine, Applicators: subject to the Engineer's approval.

3. EXECUTION

3.1 Storage

- .1 Store pavement marking materials as per manufacturer's instructions.

3.2 Site Preparation

- .1 Refer to Section 32 17 13 – Pavement Marking: General.
- .2 Prior to installing any plastic pavement markings, the Contractor or pavement marking subcontractor must provide a minimum two working days written notice to the Engineer.
- .3 Cut grooves in asphalt to designated width, length and depth as follows:
 - .1 Width and length as per Section 34 17 13 - Table 'A'.
 - .2 Depth as follows:
 - .1 Lane and Center Lines: 5 mm.
 - .2 Stop Lines, Crosswalks Lines, Guide Lines and Symbols: 10 mm.
 - .3 Remove grindings and haul to designated disposal location. Sweep or air blast groove clean and dry.
 - .4 No grooving of the roadway will be permitted in any one day beyond what can be cleaned and inlaid with thermoplastic material in that day.

3.3 Installation

- .1 Heat material and apply by extrusion process according to manufacturer's instructions.
- .2 Fill groove with hot molten material. Do not overfill more than 3.5 mm above pavement surface.
- .3 Apply glass beads to surface of extruded material while it is still molten or has not set, at a rate of 140 g/m² to 250 g/m².
- .4 Trim surplus material to give clean straight edges and let marking cure to a hardened state.
- .5 Protection and Clean-up as per Section 32 17 13 – Pavement Marking: General.

3.4 Workmanship

- .1 As specified in Section 32 17 13 – Pavement Marking: General.

3.5 Acceptance/Warranty

- .1 Warranty requirements for permanent pavement markings are specified in Section 32 17 13 – Pavement Marking: General.

1. GENERAL

This Section specifies requirements for supplying and installing chain link fence.

1.1 Related Work

.1	Cast-in-Place Concrete	Section 03 30 20
.2	Topsoil and Finish Grading	Section 32 91 21
.3	Mechanical Seeding	Section 32 92 20
.4	Hydraulic Seeding	Section 32 92 21
.5	Sodding	Section 32 92 23

2. PRODUCTS

2.1 Materials

- .1 Concrete mixes and materials to Section 03300. Concrete to have a minimum compressive strength of 20 MPa at 28 days.
- .2 Chain link fence fabric: to be 50 mm mesh grid by 3.5 mm galvanized wire to CAN/CGSB - 138.1 (vinyl coated if specified) to heights specified.
- .3 Posts, braces, and rails: to Schedule 40 to CAN/CGSB - 138.2. Material outside diameters as follows:
 - .1 Line posts - 60 mm
 - .2 End and corner - 89 mm
 - .3 Top rails - 42 mm
- .4 Gate posts as follows:

Gate Width (Span)	Gate Post Diameter
< 3.5 m	89 mm
3.5 m to 4.9 m	114 mm
>4.9 m	168 mm

- .5 Bottom tension wire: to CAN/CGSB - 138.1, Table 2, single strand galvanized (or vinyl coated) steel wire, 5 mm diameter.
- .6 Tie wire fasteners: to CAN/CGSB - 138.1, Table 2, 3.5 mm galvanized steel or Table 4, aluminium wire, single strand.

- .7 Tension bar: to ASTM A525M, 5 x 20 mm galvanized steel.
- .8 Gates: to CAN/CGSB - 138.4
- .9 Gate frames: to ASTM A53, galvanized steel pipe, standard weight, 45 mm outside diameter pipe for outside frame, 35 mm outside diameter pipe for interior bracing.
 - .1 Fabricate gates as indicated with electrically welded joints and painted with zinc pigmented paint after welding.
 - .2 Fasten fence fabric to gate with tie wire fasteners to CAN/CGSB - 138.1, Table 2, 3.5 mm galvanized steel or Table 4, aluminium wire, single strand.
 - .3 Furnish gates with galvanized malleable iron hinges, latch, and latch catch (provision for padlock to be specified in contract) which can be attached and operated from either side of installed gate.
 - .4 Furnish double gates with chain hook to hold gates open and centre rest with drop bolt for closed position.
- .10 Fittings and hardware: to Tie wire fasteners to CAN/CGSB - 138.2, cast aluminium alloy, galvanized steel or malleable or ductile cast iron. Tension bar bands: 3 x 20 mm minimum galvanized steel or 5 x 20 mm minimum aluminium. Post caps to provide waterproof fit, to fasten securely over posts and to carry top rail. Overhang tops to provide waterproof fit and hold top rails, and outward or inward projection with clips or recesses to hold three strands of barbwire spaced 100 mm apart. Projection arm to be approximately 300 mm long and project from the fence at 45° above horizontal. Turnbuckles to be drop forged.
- .11 Organic zinc rich coating: to CAN/CGSB - 1.181.
- .12 Barbwire: to CAN/CGSB - 138.2, 2.5 mm diameter galvanized steel wire to ASTM A121, two strand with four point barbs at 150 mm spacing.
- .13 Grounding rod: 16 mm diameter copperwell rod, 3 m long.

2.2 Finishes

- .1 Galvanizing
 - .1 For chain link fabric: to CAN/CGSB-138.1.
 - .2 For pipe: 550g/m² minimum to ASTM A90.
 - .3 For barbed wire: to ASTM A 121.

- .4 For other fittings to CAN/CSA-G164.
- .5 Vinyl Coating
 - .1 0.045 mm dry film thickness minimum.

3. EXECUTION

3.1 Grading

- .1 Remove debris and correct ground undulations along fence line to obtain smooth uniform gradient between posts. Provide clearance between bottom of fence and ground surface of 30 mm to 50 mm.

3.2 Erection of Fence

- .1 Erect fence along lines as indicated on drawing or as directed by the Engineer and in accordance with CAN/CGSB - 138.3.
- .2 Excavate post holes to dimensions shown on the Drawings.
- .3 Space line posts 3 m apart, measured parallel to ground surface.
- .4 Space straining posts at equal intervals, not exceeding 150 m, if distance between end or corner posts on straight continuous lengths, over reasonably smooth grade, is greater than 150 m.
- .5 Install additional straining posts at sharp changes in grade and where directed by the Engineer.
- .6 Install corner posts where change in alignment exceeds 10°
- .7 Install end posts at end of fence and at buildings. Install gateposts on both sides of gate openings.
- .8 Place concrete in postholes, embed posts into concrete to depths indicated on the Drawings. Extend concrete 50 mm above final grade and slope to drain away from posts. Brace to hold posts in plumb position and true to alignment and elevation until concrete has set.
- .9 Do not install fence fabric until concrete has cured a minimum of five days.
- .10 Install brace between end and gateposts and nearest line post parallel to ground surface. Install braces on both sides of corner and straining posts in similar manner. Brace rails to be attached using brace bands and rail ends. No brace rails are required where fabric height is 1.8 m or less.
- .11 Install caps and overhang tops. Overhang tops to face outwards.

- .12 Install top rail between posts and fasten securely to posts with brace bands and rail ends. Secure waterproof caps and overhang tops.
- .13 Install bottom tension wire, stretch tightly, and fasten securely to end, corner, gate, and straining posts with turnbuckles and tension bar bands.
- .14 Lay out fence fabric. Stretch tightly to tension recommended by manufacturer and fasten to end, corner, gate, and straining posts with tension bar secured to post with tension bar bands spaced at 300 mm intervals. Knuckled tie wire at bottom. Twisted tie wire at top.
- .15 Secure fabric to top rails, line posts and bottom tension wire with tie wires at 450 mm intervals. Give tie wires minimum two twists.
- .16 Installation of grounding rods as indicated.

3.3 Installation of Gates

- .1 Install gates in locations as indicated.
- .2 Level ground between gateposts and set gate bottom approximately 40 mm above ground surface.
- .3 Install gate rests where indicated. Determine position of centre gate rest for double gate. Cast gate rest in concrete. Finish concrete flush with ground surface.
- .4 Install gate stops where indicated.

3.4 Touch Up

- .1 Clean damaged surfaces with wire brush removing loose and cracked coatings. Apply two coats of organic zinc-rich paint to damaged areas. Pre-treat damaged surfaces according to manufacturers' instructions for zinc-rich paint.

3.5 Site Clean-up

- .1 Clean and trim areas disturbed by operations. Dispose of surplus material.
- .2 Place topsoil, as required, to provide smooth surface for seeding or sodding and to fill depression under bottom fence fabric grade line.

1. GENERAL

This Section specifies requirements for supplying and installing post and cable fencing.

1.1 Related Work

.1	Cast-in-Place Concrete	Section 03 30 20
.2	Aggregate Materials	Section 31 05 17
.3	Topsoil and Finish Grading	Section 32 91 21

2. PRODUCTS

2.1 Materials

- .1 Cable Guide Rail
 - .1 Wire cable - Diameter of 8 mm galvanized wire rope.
- .2 Square Timber Posts to CAN3-056.
 - .1 Type - pressure treated in accordance with CAN/CSA-080 Series.
 - .2 Dimensions - 150 mm x 150 mm x 2.0 m long.
- .3 Concrete mixes and materials to Section 03 30 20 – Cast-in-Place Concrete. Concrete to have a minimum compressive strength of 20 MPa at 28 days.
- .4 Aggregate - 16 mm crushed gravel to Section 31 05 17 – Aggregate Materials.

3. EXECUTION

3.1 Installation

- .1 Set posts at locations as indicated by the Engineer.
- .2 Excavate post holes to depths and diameter as indicated. Compact bottom to provide firm foundation. Set post plumb and centred in hole.
- .3 Backfill around posts and anchorages using crushed gravel and compact in uniform layers not exceeding 150 mm compacted thickness.
- .4 Cut off tops of posts as indicated.
- .5 Treat cut tops with two coats of Alkaline Copper Quaternary (ACQ).
- .6 Erect cable and hardware to details as indicated. Tension cable so that sag between posts does not exceed 25 mm.

- .7 Space cable splices a minimum of 15 m apart. Maximum one cable splice between adjacent posts.

3.2 Site Clean-up and Landscape

- .1 Clean and trim areas disturbed by operations. Dispose of surplus material.
- .2 Finished topsoil grade to be maintained to a maximum of 12 mm below top of finished level of surface and trail, pedestals, etc.

1. GENERAL

The work covered by this Section includes the furnishing of all labour, materials, equipment, and incidentals for construction and installation of modular block retaining walls as shown on the Construction Drawings.

1.1 Related Work

- | | | |
|----|------------------------|------------------|
| .1 | Cast-in-Place Concrete | Section 03 30 20 |
| .2 | Sub-Drainage | Section 33 46 17 |

1.2 Definitions

- .1 Concrete Modules: Precast concrete blocks that form the external facia of a modular block retaining wall system.
- .2 Wall Infill Soil: Soil which is placed directly behind the wall modules.
- .3 Retained Soil: An insitu soil or a specified soil which is placed behind the wall infill soil.
- .4 Foundation Soil: The insitu soil beneath the wall structure.
- .5 Base Material: Imported granular base material placed immediately beneath the concrete modules.
- .6 Drainage Material: A free draining soil with natural soil filtering capability, or a free draining soil encapsulated in a suitable geotextile, or a combination of free draining soil and perforated pipe all wrapped in a geotextile.

2. PRODUCTS

2.1 Material Handling and Storage

- .1 The Contractor shall check all materials delivered to the site to ensure that the correct materials have been received.
- .2 The Contractor shall take care to store all materials on site in such a way that no damage occurs to any of the materials. Damaged or contaminated materials shall not be incorporated into any part of the modular retaining wall system.

2.2 Materials

- .1 Concrete Modules
 - 1 Concrete wall system to be as specified on the Drawings.

.2 Wall Infill Soil

- .1 The wall infill soil shall consist of clean sand or crushed gravel as shown on the drawings and as specified in Section 31 05 17 – Aggregate Materials.

.3 Retained Soil

- .1 The retained soil shall be native soils.

.4 Foundation Soil

- .1 The foundation soil shall be on site soils, subject to approval by the Engineer.

.5 Base Material

- .1 The base material shall be compacted clean sand or crushed granular base as specified in Section 31 05 17 – Aggregate Materials, or concrete to Section 32 13 15 – Concrete Work, as shown on the Drawings.

.6 Filter Fabric

- .1 Filter fabric shall be GTF 150 non-woven or approved equal.

3. EXECUTION

3.1 Installation

- .1 Retaining wall installation shall be in accordance with the installation specifications and directions of the manufacturer and local authorities.
- .2 The Contractor to obtain copies of manufacturer's installation specifications and provide one copy to the Engineer.

1. GENERAL

This Section specifies requirements for final site grading for topsoil placement, and covers the supply, placement, modification, and preparation of topsoil.

1.1 Related Work

.1	Site Grading	Section 31 22 30
.2	Mechanical Seeding	Section 32 92 20
.3	Hydraulic Seeding	Section 32 92 21
.4	Sodding	Section 32 92 23

1.2 Site Conditions

- .1 The Contractor to verify locations of underground and surface utility lines and buried objects prior to starting work.

1.3 Protection

- .1 Prevent damage to existing trees, roots, fencing, landscaping, natural features, bench marks, existing buildings, existing pavement, surface or underground utility lines which are to remain. Make good any damage.
- .2 Protect existing trees and shrubs in accordance with best practices.
- .3 Repair costs for damages incurred will be at the expense of the Contractor.

1.4 Samples and Testing

- .1 Topsoil must be approved for use in the Work by the Engineer.
- .2 Supply to the Engineer, four weeks prior to start of topsoil placement, a one-litre sample of topsoil to be used in the Work.
- .3 Subject to the results of soil testing, the Engineer may make recommendations for modifications to the soil to make it acceptable for use in the Work. Any modifications or additives required will be considered incidental to the Work.
- .4 When source of such topsoil is exhausted, topsoil from a new source shall not be used until tested and approved by the Engineer.

2. PRODUCTS

2.1 Materials

- .1 Topsoil: A fine friable medium loam, capable of sustaining good agricultural growth, meeting accepted horticultural practices and approved by the Engineer. Topsoil shall meet the following requirements:
 - .1 Contain a minimum 4% organic matter for clay loams and minimum 2% for sandy loams.
 - .2 Acidity range pH of 6.0 to 7.8.
 - .3 Free of subsoil, roots, vegetation, weed seeds, stones larger than 50 mm in greatest dimension, or any other extraneous material.
 - .4 Topsoil containing noxious weeds is not acceptable.
- .2 Herbicide: "Round-Up" or other approved chemical base glyphosate equal.

3. EXECUTION

3.1 Preparation

- .1 Apply herbicide 10 days in advance of grading to kill existing weeds and grasses on-site, if required by the Engineer.
- .2 Fine grade subgrade, within 50 mm of design rough grade.
- .3 Fine grade subgrade, eliminating uneven areas and low spots. Remove debris, roots, branches, stones in excess of 50 mm diameter, and building materials. Remove subsoil that has been contaminated with oil or gasoline.

3.2 Spreading Topsoil

- .1 Spread dry topsoil during dry weather over approved, dry unfrozen subgrade, where indicated.
- .2 Bring topsoil up to finished grade.
- .3 Apply topsoil to 150 mm minimum depth after settlement.
- .4 Manually spread topsoil around existing trees and plants to prevent damage by grading equipment.
- .5 Care must be taken not to raise existing soil levels within drip line of plant material.
- .6 Scarify to a depth of 225 mm to break up lower horizons without substantial mixture of topsoil.

- .7 Apply 10-47-0 or equivalent fertilizer at a rate of 450 kg/ha.
- .8 Prepare loose friable seed bed by means of rototilling to a depth of 150 mm.
- .9 Dispose of debris.
- .10 Level surface to final design grades within a tolerance of 25 mm and ensure positive drainage.
- .11 Ensure that the topsoil is properly blended into the adjacent property.

1. GENERAL

This Section specifies requirements for supplying and sowing grass seeds.

1.1 Related Work

- .1 Topsoil and Finish Grading Section 32 91 21

1.2 Measurement for Payment

- .1 Payment for seeding will be made at unit price bid per square metre of area seeded according to this Section. Areas of blending into existing turf grass will not be measured for payment.

2. PRODUCTS

2.1 Grass Seed

- .1 Fine Grass Mixture: Canada "Certified" seed, "Canada No. 1 Lawn Grass Mixture" in accordance with Government of Canada Seeds Act and Seeds Regulations, according to the following grass seed mixture:
 - 35% Kentucky Blue Grass Species
 - 60% Creeping Red Fescue
 - 5% Perennial Rye
- .2 Coarse Grass Mixture: Canada "Certified" seed, "Canada No. 1 Ground Cover Mixture" in accordance with Government of Canada Seeds Act and Seeds Regulations, as specified by the Engineer.
- .3 Supply in packages individually labelled in accordance with Seeds Regulations and indicating name of supplier and date bagged.

2.2 Water

- .1 Free of impurities that would inhibit germination and growth.
- .2 Supplied by the Owner at designated source.

3. EXECUTION

3.1 Workmanship

- .1 Do not perform work under adverse field conditions such as frozen soil, excessively wet soil or soil covered with snow, ice, or standing water.
- .2 Remove and dispose of weeds, debris, stones 50 mm in diameter and larger, soil contaminated by oil, gasoline, and other deleterious materials.

3.2 Seed Bed Preparation

- .1 Verify that grades are correct. If discrepancies occur, notify the Engineer and do not commence Work until instructed by the Engineer.
- .2 Fine grade surface free of humps and hollows to smooth, even grade, to elevations indicated to tolerance of plus or minus 25 mm.
- .3 Surface drainage is to be as shown on the site grading plan.

3.3 Seed Placement

- .1 For mechanical seeding:
 - .1 Use "Brillion" type mechanical landscape seeder with sand discs which accurately places seeds at specified depth and rate and rolls in single operation.
 - .2 Use equipment and method acceptable to the Engineer.
- .2 For manual seeding:
 - .1 Use "Cyclone" type manually operated seeder.
 - .2 Rake surface to ensure seed is properly embedded.
 - .3 Remove any topsoil lumps in excess of 50 mm in size.
 - .4 Use equipment and method acceptable to the Engineer.
- .3 On cultivated surfaces, uniformly sow fine grass seed at rate of 170 kg/ha and coarse grass seed at rate of 75 kg/ha.
- .4 Blend applications 150 to 300 mm into adjacent grass areas and previous applications to form uniform surfaces.
- .5 Sow half of required amount of seed in one direction and remainder at right angles.
- .6 Embed seed into soil to depth of 6 to 10 mm. Not less than 85% of seed to be placed at specified depth and covered by soil.
- .7 Consolidate mechanically seeded areas by rolling area if soil conditions warrant, or if directed by the Engineer, with equipment approved by the Engineer immediately after seeding.
- .8 Consolidate manually seeded areas by rolling area with equipment approved by the Engineer immediately after seeding.
- .9 Protect seeded areas against damage. Remove protection material after lawn areas

have been established and accepted by the Engineer.

- .10 Avoid seeding along a road edge where freshly applied pavement markings may be contaminated or damaged.

3.4 Acceptance for Issue of Construction Completion Certificate

- .1 Seeded areas will be accepted by the Engineer provided that:
 - .1 Areas are uniformly graded and seeded to Clauses 3.1, 3.2, and 3.3 of this Section.
 - .2 Areas are free of perennial weeds, rocks, and debris.
- .2 Deficiencies to be corrected prior to issuance of the Construction Completion Certificate.

3.5 Maintenance During Warranty Period

- .1 From the issue date of the Construction Completion Certificate to the end of the one year warranty period, perform the following maintenance operations:
 - .1 Repair and reseed dead or bare spots, repair rutting, and areas of settlement to satisfaction of the Engineer.
 - .2 Repaired areas must be cut at least three times and seed must be fully established before area will be accepted.
 - .3 Cut grass to 50 mm whenever it reaches height of 100 mm.
 - .4 Eliminate weeds by mechanical means.

1. GENERAL

1.1 Related Work

- | | | |
|----|----------------------------|------------------|
| .1 | Topsoil and Finish Grading | Section 32 91 21 |
|----|----------------------------|------------------|

1.2 Product Data

- | | | |
|----|--|--|
| .1 | Provide product data for | |
| .1 | Seed | |
| .2 | Mulch | |
| .3 | Tackifier | |
| .4 | Fertilizer | |
| .5 | Erosion Control Blanket | |
| .6 | Anchors | |
| .2 | Submit in writing to the Engineer 14 days prior to commencing work: | |
| .1 | Size of truck slurry tank in litres. | |
| .2 | Amount of material to be used per tank based on size of slurry tank. | |
| .3 | Number of tank loads required per hectare to achieve specified slurry mixture per hectare. | |

1.3 Measurement for Payment

- | | | |
|----|---|--|
| .1 | Hydro-seeding will be measured in square metres of actual surface area seeded according to this Section | |
| .2 | Erosion control blanket supply and installation will be measured in square metres. | |

2. PRODUCTS

2.1 Materials

- | | | |
|----|--|--|
| .1 | Mulch | |
| .1 | Fibres: 99% organic content. | |
| .2 | Free of growth inhibiting ingredients. | |
| .3 | 100% potential water uptake by weight. | |

- .4 Capable of dispersing in water to form homogeneous slurry.
- .5 Capable of forming an absorptive mat ground cover allowing water percolation.
- .2 Tackifier: water dilutable liquid dispersion containing polyvinyl acetate polymer emulsion.
- .3 Erosion control blanket to be specified by the Engineer.
- .4 Erosion control blanket anchors:
 - .1 Staples: single or double prong "U" type, with minimum 2.5 mm diameter wire, minimum 150 mm high.
 - .2 Pegs: wooden, minimum 25 mm x 25 mm x 200 mm high.
- .5 Water: free of impurities that would inhibit germination and growth.
- .6 Fertilizer: complete synthetic, with minimum 65% water soluble nitrogen. Ratio: 1:4:1 or approved alternate.

2.2 Grass Seed

- .1 Fine Grass Mixture: Canada "Certified" seed, "Canada No. 1 Lawn Grass Mixture" in accordance with Government of Canada Seeds Act and Seeds Regulations, according to the following grass seed mixture:
 - 35% Kentucky Blue Grass Species
 - 60% Creeping Red Fescue
 - 5% Perennial Rye
- .2 Coarse Grass Mixture: Canada "Certified" seed, "Canada No. 1 Ground Cover Mixture" in accordance with Government of Canada Seeds Act and Seeds Regulations, according to the following grass seed mixture:
 - 90% Crested Wheat - Stream Bank
 - 10% Creeping Red Fescue
- .3 Supply in packages individually labelled in accordance with Seeds Regulations and indicating name of supplier and date bagged.

2.3 Equipment

- .1 Truck to be equipped with a minimum 4500 litre slurry tank and pumps capable of maintaining continuous non-fluctuating flow of solution.

3. EXECUTION

3.1 Workmanship

- .1 Take reasonable care to prevent spraying items such as structures, signs, guardrails, fences, plant materials, and utilities.
- .2 Do not perform work under adverse field conditions such as wind speeds over 20 km/hour, frozen ground, or ground covered with snow, ice, or standing water.

3.2 Preparation of Surfaces

- .1 Ensure areas to be seeded have been scarified to depth of 300 mm and are moist to depth of 150 mm before seeding. Fine grade free of humps and hollows and free of deleterious and refuse materials.
- .2 Obtain the Engineer's approval of topsoil grade and depth before starting to seed.

3.3 Slurry Application

- .1 Slurry mixture applied per hectare:
 - .1 Seed: 300 kg.
 - .2 Mulch: 1600 kg.
 - .3 Tackifier: 50 kg.
 - .4 Fertilizer: 450 kg.
 - .5 Water: quantity as required to form slurry in accordance with manufacturer's recommendations.
- .2 Apply seed slurry uniformly.
- .3 Blend applications into adjacent grass areas and previous applications to form uniform surfaces.
- .4 Reshoot areas where application is not uniform.
- .5 Remove slurry from items and areas not designated to be sprayed.

3.4 Erosion Control Blanket

- .1 Apply blanket over designated areas in accordance with manufacturer's instructions.
- .2 Anchor blanket in accordance with manufacturer's recommendations which are to be used as minimum standard and ensure that blanket is held down to maintain

firm contact with soil.

3.5 Establishment

- .1 Cut grass to 50 mm whenever it reaches height of 100 mm from time of seed application until acceptance by the Engineer.
- .2 Repair dead or bare spots to allow establishment of seed prior to acceptance.
- .3 Eliminate weeds.

3.6 Acceptance for Issue of Construction Completion Certificate

- .1 Seeded areas will be accepted by the Engineer provided that:
 - .1 Areas are uniformly graded and seeded to Clause 3.3 of this Section.
 - .2 Areas are free of perennial weeds, rocks, and debris.
- .2 Deficiencies are to be corrected prior to issuance of the Construction Completion Certificate.

3.7 Maintenance During Warranty Period

- .1 From the issue date of the Construction Completion Certificate to the end of the one year warranty period, perform the following maintenance operations:
 - .1 Repair and reseed dead or bare spots; repair rutting and areas of settlement to satisfaction of the Engineer.
 - .2 Cut grass to 50 mm whenever it reaches height of 100 mm.
 - .3 Eliminate weeds by mechanical means.

1. GENERAL

1.1 Related Work

- .1 Topsoil and Finish Grading Section 32 91 21

1.2 Source Quality Control

- .1 Obtain approval from the Engineer of sod at source.
- .2 When proposed source of sod is approved, use no other source without written authorization.

1.3 Scheduling

- .1 Schedule sod laying to coincide with topsoil operations.

2. PRODUCTS

2.1 Materials

- .1 Nursery sod: quality and source to comply with standards outlined in "Guide Specification for Nursery Stock", published by Canadian Nursery Trades Association.
 - .1 Number one Kentucky Bluegrass sod: grown from minimum mixture of three Kentucky Bluegrass cultivars.
 - .2 Number one Kentucky Bluegrass/Fescue sod: sod grown from minimum 50% Kentucky Bluegrass, 40% Creeping Red Fescue.
 - .3 Broken, dry, discoloured pieces will be rejected by the Engineer.
- .2 Wooden pegs: 17 mm x 17 mm x 200 mm.
- .3 Mesh: jute, nylon, or plastic erosion control netting approved by the Engineer.
- .4 Fertilizer: complete synthetic slow release fertilizer with maximum 35% water soluble nitrogen.
- .5 Herbicide: type, rate, and method of application subject to approval by the Engineer.

3. EXECUTION

3.1 Laying of Sod

- .1 Prior to sodding, obtain approval from the Engineer that finished grade and depth of topsoil are satisfactory.

- .2 Lay sod within 24 hours of being lifted.
- .3 Sodding during excessively wet conditions, at freezing temperatures or over frozen soils is not acceptable.
- .4 Lay sod in rows, perpendicular to slope, and with joints staggered. Butt sections closely without overlapping or leaving gaps between sections. Cut out irregular or thin sections with sharp implements.
- .5 Provide close contact between sod and soil by light rolling. Use of heavy roller to correct irregularities in grade is not permitted.
- .6 Water sod immediately after laying to obtain moisture penetration into top 100 mm of topsoil.

3.2 Laying of Pegged Sod

- .1 Place mesh on top of topsoil of slopes as indicated. Secure mesh in place with wooden pegs at maximum intervals of 1000 mm. Cover mesh lightly with topsoil.
- .2 Lay sod sections perpendicular to slopes steeper than 3:1, or as indicated, and secure with wooden pegs. Place pegs three per m², 100 mm below top edge to prevent shifting of sod and drive pegs flush with top of sod soil. Place six pegs around entire edge of each square metre of sod in drainage swales.

3.3 Maintenance Prior to Construction Completion Certificate

- .1 Maintain sodded area from start of installation until acceptance.
- .2 Water sodded areas in sufficient quantities and at frequency required to maintain soil under sod continuously moist to depth of 70 to 100 mm.
- .3 Cut grass to 50 mm when it reaches height of 100 mm. Remove clippings that will smother grassed areas.
- .4 Maintain sodded areas weed free.

3.4 Acceptance for Issue of Construction Completion Certificate

- .1 Sodded areas will be accepted by the Engineer provided that:
 - .1 Sodded areas are properly established.
 - .2 Sod is free of bare and dead spots, repair rutting and areas of settlement, and without perennial weeds.
 - .3 No surface soil is visible when grass has been cut to height of 50 mm.
 - .4 Sodded areas have been cut a minimum of two times.

- .2 Lawns sodded in fall will be accepted after June 30 provided acceptance conditions are fulfilled.

3.5 Maintenance During Warranty Period

- .1 From the issue date of the Construction Completion Certificate to the end of the one year warranty period, perform the following maintenance operations:
 - .1 Repair and re-sod dead or bare spots, repair rutting and areas of settlement to satisfaction of the Engineer.
 - .2 Cut grass to 50 mm whenever it reaches height of 100 mm.
 - .3 Eliminate weeds by mechanical means.

1. GENERAL

1.1 Related Work

- .1 Do pruning in accordance with International Society of Arboriculture Standards Tree Pruning Guidelines, except where specified otherwise.

1.2 Scheduling

- .1 Prior to commencing pruning:
 - .1 Schedule timing of work with the Engineer.
- .2 Notify the Engineer seven day in advance.
- .3 Review extent of work with the Engineer on site.

2. PRODUCTS

2.1 Disinfectant

- .1 Twenty percent (20%) solution of sodium hypochlorite or 70% solution of ethyl alcohol.

3. EXECUTION

3.1 Sample Pruning

- .1 Commence pruning by completing sample pruning operation to demonstrate technique and selection process used to establish desired form and shape.

3.2 Tool Maintenance

- .1 Ensure that tools are clean and sharp throughout pruning operation.
- .2 On diseased plant material, disinfect tools with disinfectant before each cut.

3.3 Annual Thinning

- .1 Remove dead, dying, diseased and weak growth from plant material as designated by the Engineer, in order to promote healthy growth. Retain natural form and shape of plant material.
- .2 Remove growth designated by the Engineer.
- .3 For branches under 150 mm in diameter:
 - .1 Make cuts smooth and just outside the branch collar. Do not cut lead branches unless directed by the Engineer.

- .4 For branches greater than 150 mm in diameter:
 - .1 Make first cut on lower side of limb 300 mm from trunk, one third diameter of limb.
 - .2 Make second cut on upper side of limb 500 mm from trunk until limb falls off.
 - .3 Make final cut adjacent to and outside limb collar.
- .5 Ensure that trunk bark and limb collar are not damaged or torn during limb removal.
- .6 Remove one of crossed or rubbing branches. Where removal may affect natural form or health of plant, resolve pruning action with the Engineer.
- .7 Remove exposed portion of girdling root after cleanly cutting root flush with grade on each side of parent root. Do not injure bark or parent root.

3.4 Timing of Pruning

- .1 Prune plant material at times designated by the Engineer.

3.5 Heading Back

- .1 Head back plant material designated by the Engineer.

3.6 Coniferous Evergreens

- .1 Prune plant material designated by the Engineer.

3.7 Hedges

- .1 Prune plant material designated by the Engineer.

3.8 Care of Wounds

- .1 Shape bark around wound to an oblong configuration ensuring minimal increase in wound size.

3.9 Clean-up

- .1 Collect and dispose of pruned material daily and remove from site to location specified by the Engineer.

3.10 Report

- .1 Report to the Engineer condition detrimental to health of plant material.

Section 33 05 12	Manholes and Catchbasins
Section 33 05 14	Adjustment of Manholes, Catchbasins, Hydrants and Water Valves
Section 33 11 17	Water Mains
Section 33 31 13	Sanitary Sewer Mains
Section 33 34 00	Sewage Force Mains
Section 33 41 16	Water, Sanitary and Storm Service Connections
Section 33 42 13	Corrugated Steel Pipe Culverts
Section 33 44 00	Storm Sewer Mains
Section 33 46 17	Sub-Drainage
Section 33 49 16	Catchbasin Leads
Section 33 71 15	Boring or Jacking Conduits

1. GENERAL

This Section specifies requirements for supply and installation of manholes, catchbasins, outfall structures, control structures, treatment structures and sewer appurtenances.

1.1 Related Work

.1	Submittal Procedures	Section 01 33 00
.2	Concrete Reinforcement	Section 03 20 10
.3	Cast-in-Place Concrete	Section 03 30 20
.4	Aggregate Materials	Section 31 05 17
.5	Trench Excavation and Backfilling	Section 31 23 16
.6	Adjustment of Manholes, Catchbasins, Hydrants And Water Valves	Section 33 05 14
.7	Construction Specification Drawings	Division 50

1.3 Submittals

- .1 Submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit Shop Drawing for Stormwater Treatment Units at least 4 weeks prior to beginning Work.

2. PRODUCTS

2.1 Materials

- .1 Cast-in-place concrete:
 - .1 In accordance with Section 03 30 20 - Cast-in-Place Concrete.
 - .2 Portland cement to CAN/CSA-A3001, high sulphate resistant, Type HS.
 - .3 Concrete mix design to produce 25 MPa minimum compressive strength at 28 days and containing 25 mm maximum size coarse aggregate, with water/cement ratio to CSA-A23.1.
 - .4 Air entrainment to CSA-A23.1.
 - .5 Additives: Fly ash to CAN/CSA-A23.5.

- .2 Concrete reinforcement: in accordance with Section 03 20 10 – Concrete Reinforcement.
- .3 Precast manhole units: to ASTM C478M, circular. Top sections flat slab top type with opening offset for vertical ladder installation.
- .4 Precast catchbasin sections: to ASTM C478M.
- .5 Joints as follows:
 - .1 Sanitary manhole shall have all joints made watertight utilizing rubber gaskets conforming to the requirements of CSA-A257.3 and ASTM C443, preformed bituminous gasket (Rub-R-Nec) or other approved sealant.
 - .2 Storm manholes and catchbasin barrel section joints may be left unparged. Joints between slab top, concrete adjusting rings, and frame shall be made watertight utilizing preformed bituminous gasket (Rub-R-Nec) or other approved sealant.
- .6 Mortar:
 - .1 Aggregate: to CAN3 – A82.56
 - .2 Masonry Cement: to CAN/CSA-A3002, high sulphate resistant, Type HS.
- .7 Ladder rungs: to CAN/CSA-G30.18, No.25M billet steel deformed bars, hot dipped galvanized to CAN/CSA-G164. Rungs to be safety pattern drop step type.
- .8 Adjusting rings: to ASTM C478M.
- .9 Concrete Brick: to CAN3-A165 Series.
- .10 Drop manhole pipe: to be same as sewer pipe.
- .11 Frames, gratings, covers to dimensions as indicated and following requirements:
 - .1 Metal gratings and covers to bear evenly on frames. A frame with grating or cover to constitute one unit. Assemble and mark unit components before shipment.
 - .2 Gray iron castings: to ASTM A48, Class 20.
 - .3 Ductile iron castings: to ASTM A536, Class 60-40-18.
 - .4 Castings: sand blasted or cleaned and ground to eliminate surface imperfections and coated with two applications of asphalt varnish.

- .5 Cover to Town of Sylvan Lake design.
- .12 Safety platform – aluminium grates to be MSU (Mississauga) or approved equal.
- .13 Granular bedding and backfill: in accordance with Section 31 05 17 – Aggregate Materials.
- .14 Concrete mixes and materials: in accordance with Section 03 30 20 - Cast-in-Place Concrete.

3. EXECUTION

3.1 Excavation and Backfill

- .1 Excavate and backfill in accordance with Section 31 23 16 – Trench Excavation and Backfilling as indicated.
- .2 Obtain approval of the Engineer before installing, manholes, catchbasins, outfall structures, stormwater inlet/outlet structures, stormwater outlet control structures, or stormwater treatment units.

3.2 Concrete Work

- .1 Do concrete work in accordance with Section 03 30 20 - Cast-in-Place Concrete.
- .2 Place concrete reinforcement in accordance with Section 03 20 10 - Concrete Reinforcement.
- .3 Position metal inserts in accordance with dimensions and details as indicated.

3.3 Installation

- .1 Construct units in accordance with details indicated, plumb and true to alignment and grade.
- .2 Complete units as pipe laying progresses. Maximum of three units behind point of pipe laying will be allowed.
- .3 Dewater excavation to approval of the Engineer and remove soft and foreign material before placing concrete base.
- .4 Cast bottom slabs directly on undisturbed ground.
- .5 Set precast concrete base on a minimum of 150 mm granular bedding to depth specified on Drawing 50.10.01 in Division 50, compacted to 97% Standard Proctor.

- .6 Precast units:
 - .1 Set bottom section of precast units in bed of cement mortar and bond to concrete slab or base. Make each successive joint watertight as follows:
 - .1 Sanitary manholes: with approved rubber ring gaskets or bituminous compound or combination thereof.
 - .2 Storm manholes and catchbasin barrel section joints may be left unparged. Where specified, make storm manholes watertight with approved rubber ring gaskets, bituminous compound, cement mortar or combination thereof.
 - .2 Clean surplus mortar and joint compounds from interior surface of unit as work progresses.
 - .3 Plug lifting holes with [precast] concrete plugs set in cement mortar or mastic compound.
- .7 For sewers:
 - .1 Place stub outlets and bulkheads at elevations and in positions indicated.
 - .2 Bench to provide a smooth u-shaped channel. Side height of channel to be 0.5 times full diameter of sewer. Slope adjacent floor at 10:1. Curve channels smoothly. Slope invert to establish sewer grade.
- .8 Compact granular backfill to 100% Standard Proctor.
- .9 Place unshrinkable backfill in accordance with Section 31 23 16 – Trench Excavation and Backfilling.
- .10 Installing units in existing systems:
 - .1 Where a new unit is to be installed in existing run of pipe, ensure full support of existing pipe during installation. Carefully remove portion of existing pipe to dimensions required and install new unit as specified.
 - .2 Make joints watertight between new unit and existing pipe.
 - .3 Where deemed expedient to maintain service around existing pipes and when systems constructed under this Project are ready to be put in operation, complete installation with appropriate break-outs, removals, redirection of flows, blocking unused pipes or other necessary work.

- .11 Set frame and cover to required elevation on no more than three concrete rings and no more than one course of brick. Make brick joints and join brick to frame with cement mortar. Parge and make smooth and watertight using bituminous gasket.
- .12 Place manhole frame and cover on top section to an elevation 5 mm below finished asphalt surface elevation or 19 mm to 25 mm below finished gravel lane surface. If adjustment required use concrete ring.
- .13 Place catchbasin frame and cover on top section to an elevation 10 mm below finished surface elevation and 10 mm behind the face of curb.
- .14 Clean units of debris and foreign materials. Remove fins and sharp projections. Prevent debris from entering system.
- .15 Install safety platforms in manholes having depth of 6 m or greater, as indicated.

3.4 Adjustment of Existing Units

- .1 As per Section 33 05 14 – Adjustment of Manholes, Catchbasins, Hydrants and Water Valves.

1. GENERAL

This Section specifies requirements for adjusting existing manholes, catchbasins, hydrants, and water valves.

1.1 Related Work

- | | | |
|----|--------------------------|------------------|
| .1 | Manholes and Catchbasins | Section 33 05 12 |
| .2 | Water Mains | Section 33 11 17 |

1.2 Measurement for Payment

- .1 Adjustment of manholes, catchbasins, hydrants and water valves to be measured by number adjusted.
- .2 In contracts with underground and roadways combined, payment for adjustment of appurtenances is included in Section 33 05 12 – Manholes and Catchbasins.

2. PRODUCTS

2.1 Materials

- .1 Precast manhole section to ASTM C478 circular. Top sections eccentric cone or flat slab top type with opening offset.
- .2 Precast catchbasin sections to ASTM C139, ASTM C478.
- .3 Mortar
 - .1 Aggregate to CAN3-A82.56.
 - .2 Cement to CAN3-A3002, high sulphate resistant, Type HS.
- .4 Ladder rungs 20 mm diameter Galvanized preformed steel or aluminum rungs. Rungs to be safety pattern (drop step type).
- .5 Adjusting rings to ASTM C478.
- .6 Concrete brick to CAN3-A165.2.
- .7 All exterior hydrant extension bolts and nuts to be T304 stainless steel.

3. EXECUTION

3.1 Manholes and Catchbasins

- .1 Remove existing grates and frames; store for re-use at locations designated by the

Engineer, if required.

.2 Sectional units:

- .1 Raise or lower straight walled sectional units by removing slab top and adding or removing precast sections as required.
- .2 Raise or lower tapered units by removing cone section, adding, removing or substituting riser sections to obtain required elevation, then replace cone section with slab top.
- .3 When amount of raise is less than 300 mm use standard manhole brick or grade rings.

.3 Monolithic Units:

- .1 Raise monolithic units by roughening existing top to ensure proper bond and extend to required elevation with mortared brick course for 150 mm or less alteration.
- .2 Lower monolithic units with straight wall by removing concrete to elevation indicated for rebuilding.
- .3 When monolithic units with tapered upper section are to be lowered more than 150 mm, remove concrete for entire depth of taper plus as much straight wall as necessary, then rebuild upper section to required elevation with cast-in-place concrete.
- .4 Install additional manhole ladder rungs in adjusted portion of units as required.
- .5 Re-use existing gratings and frames.
- .6 Re-set gratings and frames to required elevation on no more than three concrete rings and no more than one course of brick. Make brick joints and join brick to frame with cement mortar, parge and trowel smooth.
- .7 Re-set gratings and frames to required elevation on full bed of cement mortar, parge and trowel smooth.

.4 Frame and Cover:

- .1 Recess catchbasin frame and cover 10 mm below gutter elevation and 10 mm behind the face of curb.
- .2 Recess manhole frame and cover 5 mm below finished asphalt surface elevation or 19 mm to 25 mm below finished gravel lane surface. If adjustments required, remove or add concrete rings, not to exceed

allowable.

- .3 Join brick course to frame with cement mortar, parge and make smooth and watertight using bituminous gasket (Rub-R-Nec)

- .5 Install additional ladder rungs in manholes as directed by the Engineer.

3.2 Water Valves

- .1 Excavate and expose adjustable portion of water valve casing.
- .2 Adjust water valve casing to design elevation.
- .3 Recess top of water valve 5 mm below finished asphalt surface elevation or to a maximum of 25 mm below finished gravel lane surface.
- .4 Backfill excavation. Ensure water valve casing will not settle.
- .5 Operate valve in presence of the Engineer to verify it is operational.

3.3 Hydrants

- .1 Excavate and expose top extension section of fire hydrant.
- .2 Remove existing extension section and hydrant rod, and replace with appropriate unit to place hydrant within 25 mm of design elevation.
- .3 Operate hydrant in presence of the Engineer to verify it is operational.

1. GENERAL

This Section specifies requirements for supplying and installing pressure water main pipe and appurtenances.

1.1 Related Work

.1	Cast-In-Place Concrete	Section 03 30 20
.2	Trench Excavation and Backfilling	Section 31 23 16
.3	Manholes and Catchbasins	Section 33 05 12
.4	Water, Sanitary and Storm Service Connections	Section 33 41 16
.5	Boring or Jacking Conduits	Section 33 71 15
.6	Construction Specification Drawings	Division 50

1.2 Scheduling of Work

- .1 Maintenance
 - .1 Schedule work to minimize interruptions to existing services.
 - .2 Submit schedule of expected interruptions for approval by the Engineer.
 - .3 Notify the Engineer and affected consumers, a minimum of 24 hours of advance, of any interruption in service.
 - .4 Notify the Town of Sylvan Lake Public Works Department (403.887.2800) of any planned or accidental interruption of water supply to hydrants.

1.3 Protection

- .1 Disruption of Water Supply
 - .1 Notify all consumers in writing at least 24 hours prior to any anticipated interruptions in their water service. Where possible, schedule interruptions to occur in non-peak hours. If interruption is to last longer than eight hours, provide temporary water service to each house via surface hoses connected to outside taps of each house. Care must be taken with temporary water lines to prevent contamination.
- .2 Boundary Valve Operation During Construction
 - .1 Boundary valves are valves that isolate new water main construction from

existing water mains serving people with potable water. These valves protect the public from contamination of their drinking water caused by backflow from undisinfected water mains, excessive chlorine concentrations, and excessive hydrostatic pressure. Extreme care must be taken when opening and closing boundary valves to ensure that the water serving consumers remains safe for consumption and that the consumer is not inconvenienced.

- .2 The Contractor is responsible for the operation of boundary valves for this Contract. These boundary valves shall have their valve box tops painted pink to identify them.
- .3 Prior to construction, the Contractor shall designate a site representative who will be responsible to ensuring the opening, closing and associated documentation of the boundary valves, during pressure testing, leakage testing, disinfection and flushing operations is performed properly.
- .4 The Engineer and The Town of Sylvan Lake's Public Works Department must be provided with a drawing indicating all of the boundary valves that will be required for the project, before the construction begins on any new water main. Drawings can be delivered to: #1 Industrial Drive.
- .5 A boundary valve cannot be operated without 24 hours prior notification to the Engineer. The Contractor is responsible for notifying Public Works of any change in boundary valve status.
- .6 Each time a boundary valve is operated, a record is to be kept by the Contractor, detailing valve, date, time, duration, and type of operation performed. These records will be provided to the Engineer and the Public Works Operator when the work is completed and shall form part of the application for the Construction Completion Certificate.
- .7 It will remain the responsibility of the Contractor to ensure that boundary valves are kept closed and secured until Construction Completion Certificates are issued, except for the following construction activities:
 - filling water mains for wet tapping of services
 - pressure and leakage testing
 - disinfection and subsequent flushing
 - other instances specifically approved by the Engineer
- .8 To prevent backflows, not more than one boundary valve is to be operated at one time.
- .9 At the discretion of The Town of Sylvan Lake's Public Works, operation of all boundary valves may be restricted to Town Forces, the cost of which shall be borne by the Contractor.

2. PRODUCTS

2.1 Pipe

- .1 Polyvinyl chloride pressure pipe to CAN3-B.137.3 (AWWA C900 for 100 mm to 300 mm diameter pipe and AWWA C905 for 350 mm to 1,200 mm diameter pipe), pressure class 150, cast iron outside diameter, designated DR 18, and coloured blue.

2.2 Pipe Joints

- .1 Polyvinyl chloride pipe joints to be bell and spigot joints with gaskets conforming to AWWA C111. Mechanical and flange joints with gaskets conforming to AWWA C111 to be used when specified or approved by the Engineer. Denso tape or approved equal to be applied to all mechanical joint fittings.

2.3 Fittings

- .1 Polyvinyl chloride fittings to CAN 3-B.137.3, pressure class 150, with bell-end joints and gaskets conforming to AWWA C111. Fittings to be DR 18, size range up to 900 mm, conforming to AWWA C900, C905 and C907.
- .2 Ductile iron cast fitting to AWWA C110 with bell-end joints, with gaskets conforming to AWWA C111. Mechanical and flange joints as specified or approved by the Engineer, with gaskets conforming to AWWA C111, and ANSI 303 stainless steel bolts, hexhead nuts, and washers conforming to ASTM A-3200.
- .3 Ductile iron cast couplings to be Robar 1506, epoxy coated couplings or approved equal, complete with T304 (ASTM A743) stainless steel nuts and bolts, compatible with outside diameters of pipes to be joined in locations approved or specified by the Engineer.

2.4 Valves and Valve Boxes

- .1 Gate valves to be resilient seat gate valves conforming to AWWA C509, and approved for potable water service.
 - .1 Working pressure 1034 kPa.
 - .2 Iron body, double disc or solid wedge with full 360E rubber to cast iron resilient seat. Resilient seat to be bonded or mechanically attached to gate and valve body.
 - .3 Valve interior to be epoxy coated for corrosion protection.
 - .4 Non-rising stem with o-ring seals.

- .5 50 mm square operating nut.
- .6 Valves to open counter-clockwise
- .7 Exterior to be factory coated.
- .8 All exterior bolts and nuts must be T304 stainless steel.
- .9 All valves are to include an operation rod with rock guard.
- .2 Butterfly valves to be rubber seat valves conforming to AWWA C504.
 - .1 Working pressure 1034 kPa.
 - .2 Side-mounted, travelling nut on non-rising stem for direct bury operation.
 - .3 Valves to open counter-clockwise.
 - .4 To be used on 350 mm and large diameter mains when specified by the Engineer.
 - .5 All exterior bolts and nuts must be T304 stainless steel.
- .3 Ductile iron cast valve boxes to be bituminous coated three piece screw down type, Norwood type B or approved equal.

2.5 Hydrants

- .1 Hydrant to be post type, dry top design, with compression shut-off conforming to AWWA C502, and be listed with Underwriter's Laboratories of Canada and Factory Mutual.
- .2 Minimum flow 60 litres per second.
- .3 Minimum working pressure of 1034 kPa (150 psi).
- .4 Main valve opening of 133.3 mm (5 1/4 in.).
- .5 "O" ring positive type seals.
- .6 Grease lubricated operating mechanism.
- .7 360° rotation of upper body.
- .8 Hose connection:
 - .1 Two hose connections at 180° with 65 mm I.D., 75 mm thread O.D. with Alberta Mutual Thread.

- .2 One pumper connection with 114 mm I.D., 147 mm thread O.D., and 4 threads per 25 mm.
- .9 32 mm pentagonal shaped operating nut and hose nozzle caps.
- .10 Counter clockwise opening.
- .11 Four, six, or eight bolt connection flanges.
- .12 Bury of 2.75 m overall including a 450 mm top extension.
- .13 Hydrant rod to be coupled at the top and bottom of extension.
- .14 Ground line breakaway system.
- .15 All exterior bolts, nuts, and washers to be 18-8, type T304 stainless steel.
- .16 Drain holes plugged externally by means of threaded plugs.
- .17 Inlet elbow connection to be 150 mm "push on", bell end complete with gasket for PVC DR 18, C-900, water pipe.
- .18 Dimension from top of operating nut to bottom of base flange to a minimum of 660 mm.
- .19 Upper body colour - fire engine green (Cloverdale alkyd metal primer 71309 grey.
Finish coat - Cloverdale modified alkyd gloss speed enamel 76002, PG-8, MY-2Y, 0Y-6Y, TW-2Y, YO-2I, BG-per 01, lead free paint.
- .20 Approved hydrants are Canada Valve Century and Clow Brigadier M-67.

2.6 Subsurface Protection

- .1 Denso tape or approved equal.

2.7 Valve Chambers

- .1 Valve chambers to Section 33 05 12 – Manholes and Catchbasins.

2.8 Pipe Disinfection

- .1 Sodium hypochlorite, calcium hypochlorite or liquid chlorine to AWWA B300 or AWWA B301 to disinfect water mains.

2.9 Insulation

- .1 Insulation to Section 31 32 41 – Soil Insulation.

3. EXECUTION

3.1 Preparation

- .1 Clean pipes, fittings, valves, hydrants, and appurtenances of accumulated debris and water before installation. Carefully inspect materials for defects. Remove defective materials from site.

3.2 Trenching, Bedding and Backfill

- .1 Do trenching, bedding, and backfill work in accordance with Section 31 23 16 – Trench Excavation and Backfilling.
- .2 Trench alignment and depth as established by the Engineer.
- .3 Do not backfill trenches until installed work has been inspected by the Engineer.

3.3 Pipe Installation

- .1 Lay pipes to manufacturer's standard instructions and specifications.
- .2 Join pipes in accordance with manufacturer's recommendations. Apply a minimum amount of pipe lubricant only to the bevelled end of the pipe spigot.
- .3 Handle pipe by approved methods. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.
- .4 Lay pipes on prepared bed, true to line and grade. Ensure barrel of each pipe is in contact with shaped bed through out its full length. Remove and replace defective pipe. Correct pipe which is not in true alignment or grade or pipe which shows undue settlement after installation.
- .5 Face socket ends of pipe in direction of laying. For mains on a grade of 2% or greater, face socket ends up-grade.
- .6 Do not exceed permissible deflection at joints or bending through length of pipe as recommended by pipe manufacturer.
- .7 Keep jointing materials and installed pipe free of dirt and water and other foreign materials. Whenever work is stopped, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
- .8 Position and join pipes with equipment and methods approved by the Engineer. Do NOT insert pipe spigot too far into bell as recommended by pipe manufacturer.
- .9 Cut pipes in an approved manner as recommended by pipe manufacturer, without

damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.

- .10 Align pipes carefully before jointing.
- .11 Install gaskets to manufacturer's recommendations. Support pipes with hand slings or crane as required minimizing lateral pressure on gasket and maintaining concentricity until gasket is properly positioned.
- .12 Avoid displacing gasket or contaminating with dirt or other foreign material. Gaskets so disturbed or contaminated shall be removed, cleaned, lubricated and replaced before jointing is attempted again.
- .13 Complete each joint before laying next length of pipe.
- .14 Minimize deflection after joint has been made.
- .15 Apply sufficient pressure in making joints to ensure that joint is completed to manufacturer's recommendations.
- .16 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes or as otherwise approved by the Engineer.
- .17 When work stoppage occurs, block pipes in an approved manner to prevent creep during down time.
- .18 Recheck plastic pipe joints assembled above ground after placing in trench to ensure that no movement of joint has taken place.
- .19 Do not lay pipe on frozen bedding.
- .20 Protect hydrants, valves, and appurtenances from freezing.
- .21 Upon completion of pipe laying and after the Engineer has inspected work in place, surround and cover pipes between joints with approved granular material placed to dimensions indicated or directed by the Engineer.

3.4 Valve and Fitting Installation

- .1 Install valves and fittings to manufacturer's recommendations at locations indicated.
- .2 Support valves located in valve boxes or valve chambers by means of wood blocks, located between valve and solid ground.
- .3 All subsurface bolted connections in contact with the soil shall be wrapped in denso tape.

3.5 Valve Chambers

- .1 Construct valve chambers to Section 33 05 12 – Manholes and Catchbasins.

3.6 Boring or Jacking

- .1 Boring or jacking to Section 33 71 15 – Boring or Jacking Conduits.

3.7 Hydrants

- .1 Install hydrants at locations indicated or directed.
- .2 Install hydrants in accordance with AWWA Manual of Practice M-17.
- .3 Install 150 mm gate valve and cast iron valve box on hydrant service leads as indicated.
- .4 Set hydrants plumb, with hose outlets parallel with edge of pavement or curb line, with pumper connection facing roadway and with body flange set at elevation of 100 mm above final sidewalk grade.
- .5 Ensure drain plug is installed.
- .6 Hydrants may be used for pressure testing, disinfection, and flushing of water mains. They must be operated in full open position only. To restrict flow, attach a secondary valve to hydrant nozzle. All hydrants to be pumped dry to prevent freezing.
- .7 Install an “Out of Service” disk on one of the hose connections. The disk will be removed by Town Forces as outlined in Clause 3.10 of this Section.

3.8 Thrust Blocks

- .1 Do concrete work in accordance with Section 03 30 20 – Cast-In-Place Concrete.
- .2 Place concrete thrust blocks between undisturbed ground, tees, plugs, caps, bends, reducers, hydrants, and fittings as indicated in Division 50 or Specific Drawings.
- .3 Keep joints and couplings free of concrete.
- .4 Do not backfill over concrete within 24 hours after placing.

3.9 Hydrostatic and Leakage Testing

- .1 Provide labour, equipment and materials required to perform hydrostatic and leakage tests hereinafter described.
- .2 Notify the Engineer at least 24 hours in advance of all proposed tests. Perform

tests in presence of the Engineer.

- .3 Where any section of system is provided with concrete thrust blocks, do not conduct tests until at least five days after placing concrete or two days if high early strength concrete is used.
- .4 Test pipeline in sections not exceeding 365 m in length, unless otherwise authorized by the Engineer.
- .5 Test pipeline, including service connections after all backfilling is complete.
- .6 Open valves within test section.
- .7 Expel air from main by slowly filling main with potable water. Install corporation stops where required to expel air at high points, or to flush dead ends in main, as directed by the Engineer. Close stops after satisfactory completion of test. **Air pressure testing of installed P.V.C. pressure pipe is expressly prohibited for safety reasons.**
- .8 Apply hydrostatic test pressure of 1035 kPa or 1.5 times the normal operating pressure based on elevation of lowest point in main and corrected to elevation of test gauge, for a period of two hours.
- .9 Relieve hydrostatic pressure on each section of pipeline segment at the end of the test period.
- .10 Define leakage as amount of water supplied in order to maintain test pressure for two hours.
- .11 Do not exceed allowable leakage as defined in AWWA C605 using the following formula:

For PVC:
$$L = \frac{N \times D \times P^{0.5}}{128,320}$$

P - test pressure (kPa) (1.0 PSI = 6.9 kPa)
D - nominal diameter (mm)
N - number of mechanical joints
L - allowable leakage per hour (l/hour)
- .12 Locate and repair defects if leakage is greater than amount specified.
- .13 Repeat test until leakage is within specified allowance for full length of water main.

3.10 Flushing and Disinfecting

- .1 A drawing detailing the proposed flushing sequence and valving required is to be

- approved and signed by the Engineer and the Public Works Department before commencement of flushing.
- .2 Upon acceptance of disinfection by the Engineer, flushing may proceed. system water is scheduled to commence. Flushing may be limited to off-peak hours.
 - .3 Flushing and disinfecting operations shall be witnessed by the Engineer. Notify the Engineer at least 24 hours before the proposed date when disinfection will commence.
 - .4 Provide connections and pumps as required.
 - .5 Flush and disinfect all water mains, stubs longer than 12.2 m, and services greater than 50 mm in diameter to AWWA C651. The point of application shall be at or near the beginning of the pipe extension and the discharge shall be at or near the end of the line being treated. Hydrants shall not be used for point of application of sodium hypochlorite or liquid chlorine.
 - .6 Flushing is to be directed to the sanitary sewer and continue until all heavily chlorinated water, pipe lubricant or other materials that may have entered the main during construction have been expelled.
 - .7 Dechlorination of the chlorinated water will be required in the event a sanitary manhole is not available for receiving this water in order to meet the regulatory requirements of The Town of Sylvan Lake or Alberta Environment. Dechlorination, if required, is to be performed by adding neutralizing chemicals (AWWA C651, Appendix B) to the chlorinated water as it is flushed from the system and before it enters the receiving environment.
 - .8 After final flushing, the Engineer will allow 12 hours to pass before collecting water samples for bacteriological testing. The water main is to be flushed for not more than five minutes before taking the sample. One sample is to be taken from each leg of the water main, stubs longer than 12.2 m, and services greater than 50 mm in diameter.
 - .9 Bacteriological samples are to be collected by the Engineer in approved sample bottles obtained from the Provincial Laboratory of Public Health or the local Health Unit. The sample bottles are sterilized and contain a dechlorination reagent. Never rinse sample bottle before testing. The locations where each sample is taken must be clearly identified on the Provincial Laboratory Public Health form, PH 108, provided with each sample bottle. **Indicate the sample is from a newly constructed water main.**
 - .10 No new water main will be put into service until all excess pipe lubricant has been flushed from the main and the results of the bacteriological tests have been provided to The Town of Sylvan Lake, stating the water is free from contamination. **Once satisfactory bacteriological test results have been confirmed and water quality is found to be free of pipe lubricant, have a**

chlorine residual between 0.5mg/L and 3.0mg/L and turbidity of less than 5.0 NTU, The Town of Sylvan Lake will commission the new water main. Out of service disks will then be removed from all fire hydrants in the approved zone.

- .11 If the initial disinfection fails to produce satisfactory bacteriological samples, the mains may be reflashed and resampled. If check samples show the presence of coliform organisms, then the water main shall be rechlorinated and flushed until satisfactory results are obtained.
- .12 Water mains to be flushed again after streets are constructed and before issuance of building permits.

1. GENERAL

This Section specifies requirements for supplying and installing gravity sanitary sewer pipe and service connections.

1.1 Related Work

.1	Basic Concrete Materials and Test Methods	Section 03 05 13
.2	Trench Excavation and Backfilling	Section 31 23 16
.3	Manholes and Catchbasins	Section 33 05 12
.4	Water, Sanitary and Storm Service Connections	Section 33 41 16
.5	Boring or Jacking Conduits	Section 33 71 15
.6	Construction Specification Drawings	Division 50

1.2 Scheduling of Work

- .1 Schedule work to minimize interruptions to existing services.
- .2 Maintain existing sewage flows during construction.
- .3 Submit schedule of expected interruptions for approval and adhere to approved schedule.

2. PRODUCTS

2.1 Concrete Pipe

- .1 Reinforced circular concrete pipe: ASTM C76 and designed for flexible rubber gasket joints.
- .2 Rubber gaskets to be confined "O" ring and shall meet the specification of ASTM C443.

2.2 Plastic Pipe

- .1 All 200 mm sanitary sewer pipe to be PVC SDR 35.
- .2 PVC pipe accepted to maximum size of 1200 mm; to meet CSA B182.4.
- .3 Polyvinyl Chloride (PVC) to ASTM D3034, CSA B182.1, and B182.2.
 - .1 Standard dimensional ratio (SDR), 35.
 - .2 Separate gasket and integral bell system.

- .3 All joints to meet requirements of specification for joints for drain and sewer plastic pipes using flexible elastomeric seals (ASTM 03212).
- .4 Ultra-Rib PVC pipe and fittings to meet CSA B182.4, ASTM F794 and Uni-bell Uni-B-9.
 - .1 Minimum pipe stiffness to be 320 kPa as measured in accordance with ASTM Standard D2412.
 - .2 Gaskets shall be as designed for Ultra-Rib pipe and shall meet the requirements of ASTM F477.
- .5 Royal Kor-Flo PVC pipe and fittings to meet CSA B182.4, ASTM 794 and Uni-bell Uni-B-9.
 - .1 Minimum pipe stiffness to be 320 kPa as measured in accordance with ASTM Standard D2412.
 - .2 Gaskets shall be as designed for Royal Kor-Flo pipe and shall meet the requirements of ASTM F477.
- .6 May be any colour except blue.

2.3 Cement Mortar

- .1 Portland cement to CAN3-A3001, high sulphate resistant, Type HS.
- .2 Mix mortar one part by volume of cement to two parts of clean, sharp sand mixed dry. Add only sufficient water after mixing to give optimum consistency for placement. Do not use additives.
- .3 Refer to Section 03 05 13 – Basic Concrete Materials and Test Methods.

2.4 Insulation

- .1 If required in locations as shown on drawings pipe shall be field insulated with extruded polystyrene board, Type HI-40 or approved equal as detailed.

3. EXECUTION

3.1 Preparation

- .1 Clean pipes and fittings of debris and water before installation. Inspect materials for defects before installing. Remove defective materials from site.

3.2 Trenching, Bedding, and Backfilling

- .1 Do trenching, bedding, and backfill work in accordance with Section 31 23 16 –

Trench Excavation and Backfilling.

- .2 Trench line and depth require approval prior to placing bedding material and pipe.
- .3 Do not backfill trenches until pipe grade and alignment have been checked and accepted by the Engineer.

3.3 Installation

- .1 Lay and join pipe in accordance with manufacturer's recommendations.
- .2 Handle pipe with approved equipment. Do not use chains or cables passed through pipe bore so that weight of pipe bears upon pipe ends.
- .3 Lay pipes on prepared bed, true to line and grade with pipe inverts smooth and free of sags or high points. Ensure barrel of each pipe is in contact with shaped bed throughout its full length.
- .4 Commence laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.
- .5 Do not exceed maximum joint deflection or maximum bending radius recommended by pipe manufacturer.
- .6 Do not allow water to flow through pipes during construction except as may be permitted by the Engineer.
- .7 Whenever work is suspended, install removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
- .8 Position and join pipes by approved methods. Do not use excavating equipment to force pipe sections together.
- .9 Pipe Jointing
 - .1 Install gaskets as recommended by manufacturer.
 - .2 Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.
 - .3 Align pipes carefully before joining.
 - .4 Maintain pipe joints free from mud, silt, gravel and other foreign material.
 - .5 Avoid displacing gasket or contaminating with dirt or other foreign material. Remove disturbed or dirty gaskets; clean, lubricate and replace before joining is attempted.

- .6 Complete each joint before laying next length of pipe.
- .7 Minimize joint deflection after joint has been made to avoid joint damage.
- .8 At rigid structures, install pipe joints not more than 1.2 m from side of structure.
- .9 Apply sufficient pressure in making joints to ensure that joint is complete as outlined in manufacturer's recommendations.
- .10 Block pipes as directed when any work stoppage occurs, to prevent creep during down time.
- .11 Plug lifting holes with approved prefabricated plugs set in non-shrink grout.
- .12 Cut pipes as required for special inserts, fittings or closure pieces in a neat manner, as recommended by pipe manufacturer, without damaging pipe or its coating and to leave a smooth end at right angles to axis of pipe.
- .13 Make watertight connections to manholes. Use non-shrink grout when suitable gaskets are not available.
- .14 Use prefabricated saddles, tees, or approved field connections for connecting pipes to existing sewer pipes. Joint of saddle to pipe shall be structurally sound and watertight.
- .15 Upon completion of pipe laying and after the Engineer has inspected pipe joints, place specified granular material to dimensions indicated or directed and in accordance with Section 31 23 16 – Trench Excavation and Backfilling.
- .16 Backfill remainder of trench in accordance with Section 31 23 16 – Trench Excavation and Backfilling.

3.4 Boring and Jacking

- .1 Refer to Section 33 71 15 – Boring or Jacking Conduits.

3.5 Service Connections

- .1 Refer to Section 33 41 16 – Water, Sanitary and Storm Service Connections.

3.6 Infiltration

- .1 Do infiltration testing as directed by the Engineer. Perform tests in presence of the Engineer. Notify the Engineer 24 hours in advance of proposed tests.
- .2 Carry out tests on each section of sewer between successive manholes including

service connections.

- .3 Install watertight bulkheads in suitable manner to isolate test section from rest of pipeline.

- .4 Infiltration Test

- .1 Conduct infiltration test where static ground water level is 750 mm or more above top of pipe measured at highest point in line to be used.
- .2 Do not interpolate a head greater than 750 mm to obtain an increase in allowable infiltration rate.
- .3 Install watertight plug at upstream end of pipeline test section.
- .4 Place 90° V-notch weir or other measuring device approved by the Engineer in invert of sewer at each manhole.
- .5 Measure rate of flow over minimum of 1 hour, with recorded flows for each five minute interval.
- .6 Infiltration not to exceed following limits in litres/day/mm pipe diameter/km pipe length, including service connections:
 - .1 plastic pipe – 5
 - .2 concrete pipe - 20
- .7 Repair and retest sewer line as required, until test results are within limits specified.
- .8 Repair visible leaks regardless of test results.

3.7 Testing

- .1 Camera Testing

- .1 All sanitary mains are to be inspected using closed circuit television with a copy of the report and video forwarded to the Engineer. Any defects identified are to be corrected at the Contractor's expense.
- .2 The Construction Completion Certificate for sanitary mains will not be issued until the camera inspection report is complete and approved by the Engineer.

- .2 Alignment and Grade

- .1 Sewer main will be checked for alignment by the Engineer during construction. Any deviation from design alignment greater than 50 mm

shall be corrected prior to backfilling.

- .2 Sewer main design grade to be maintained as directed by the Engineer. Any apparent discrepancies are to be reported immediately. Grade to be continuous through manhole. Invert elevation shall be within 50 mm of design elevation at manholes.

- .3 Visual Inspection

- .1 Sewer mains shall be tested by means of a light test. For satisfactory alignment, illuminated interior of pipe shall not show any substantial misalignments of pipes or gaskets nor other defects. On large diameter pipes where light test not effective, pipe interior shall be inspected by walking through pipe.
- .2 Any defects located shall be repaired at the Contractor's expense as directed by the Engineer.

1. GENERAL

This Section specifies requirements for supplying and installing sewage force main pipe and appurtenances.

1.1 Related Work

- | | | |
|----|-----------------------------------|------------------|
| .1 | Trench Excavation and Backfilling | Section 31 23 16 |
| .2 | Boring or Jacking Conduits | Section 33 71 15 |

1.2 Scheduling of Work

- .1 Schedule work to minimize interruptions to existing services.
- .2 Submit schedule of expected interruptions and adhere to approved schedule.
- .3 Notify the Engineer a minimum of 24 hours in advance of any interruption in service.

2. PRODUCTS

2.1 Materials

- .1 Polyvinyl chloride pressure pipe series 160 (SDR 26) conforming to CSA B137.3.
 - .1 Pipe joints: bell and spigot with rubber gaskets solvent welded joints or mechanical joints to CSA B131.10 with transition gaskets to pipe manufacturer's specifications.
 - .2 Cast iron fittings to CAN3-B131.9. The Engineer is to approve the use of cast iron fittings.
 - .3 PVC fittings to CAN3-B137.3, pressure class 150.
- .2 High Density Polyethylene Class 160 (DR 11) pressure pipes conforming to CSA B137.1
 - .1 Joints to AWWA C207, thermal butt fusion.
 - .2 Cast iron fittings with flanged ends to CAN3-B131.9. The Engineer is to approve the use of cast iron fittings.
 - .3 Polyethylene fittings to CAN-B137.1.

3. EXECUTION

3.1 Preparation

- .1 Clean pipes and fittings of debris and water before installation. Carefully inspect materials for defects before installing. Remove defective materials from site.

3.2 Trenching, Bedding, and Backfill

- .1 Do trenching, bedding, and backfill in accordance with Section 31 23 16 – Trench Excavation and Backfilling.
- .2 Trench alignment and depth require approval prior to placing bedding material or pipe.
- .3 Do not backfill trenches between joints until pipe slope and alignment have been checked and accepted.

3.3 Boring and Jacking

- .1 Refer to Section 33 71 15 – Boring or Jacking Conduits

3.4 Installation

- .1 Lay pipes in accordance with manufacturer's recommendations. Do not use blocks to support pipe.
- .2 Join pipes in accordance with manufacturer's recommendations. Ensure pipe spigot does NOT exceed the insertion limit into the bell end.
- .3 Avoid damage to machined ends of pipes in handling and moving pipe.
- .4 Maintain grade and alignment of pipes.
- .5 Align pipes carefully before jointing.
- .6 Support pipe firmly over entire length, allowing for clearance necessary at joints.
- .7 Keep pipe and pipe joints free from foreign material.
- .8 Avoid bumping gasket and knocking it out of position, or contaminating with dirt or other foreign material. Gaskets so disturbed to be removed, cleaned, lubricated, and replaced before jointing is attempted.
- .9 Support pipes by means of hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.
- .10 Apply sufficient pressure in making joint to ensure that joint is complete to manufacturer's recommendations.
- .11 Snake polyethylene pipe in the trench to allow for thermal contraction.
- .12 Apply restraint to force main to ensure that joints when completed are held in

place, by tamping fill material under and alongside pipe, or otherwise as approved by the Engineer.

- .13 Block pipe as directed when any stoppage of work occurs to prevent creep during downtime.

3.5 Thrust Blocks

- .1 Place concrete thrust blocks between bends, tees and fittings and undisturbed ground.
- .2 Keep pipe couplings free of concrete.
- .3 Bearing area of thrust blocks to be as indicated on drawings.

3.6 Field Testing of Force Main (PVC Pipe)

- .1 Testing of force main to be carried out in presence of the Engineer.
- .2 Before testing, bed and cover pipe between joints to prevent movement of force main when test pressure is applied.
- .3 Expel air from force main, by slowly filling main with water. High points to be drilled and tapped and suitable cocks installed to vent air and to be shut when pressure is applied. Remove cocks after satisfactory completion of test and seal holes with tight fittings plugs.
- .4 Apply a hydrostatic test pressure of 1035 kPa based on elevation of lowest point in line and corrected to elevation of test gauge for two hours.
- .5 Define leakage as amount of water supplied in order to maintain test pressure for two hours.
- .6 Do not exceed allowable leakage as defined in AWWA C605 using the following formula:

$$\text{For PVC: } L = \frac{N \times D \times P^{0.5}}{128,320}$$

P - test pressure (kPa) (1.0 PSI = 6.9 kPa)

D - nominal diameter (mm)

N - number of mechanical joints

L – allowable leakage per hour (l/hour)

- .7 Locate and repair defects if leakage is greater than amount specified in Item 3.5.6.
- .8 Repeat test until leakage is within specified allowance for full length of force main.

3.7 Field Testing of Force Main (HDPE Pipe)

- .1 Testing of force main to be carried out in presence of the Engineer.
- .2 Test pressure is to be 1.5 times the rated pressure of the pipe at the lowest elevation in the system.
- .3 To compensate for initial pipe stretch, a period of 3 hours is required to pressurize the pipe, plus 1 hour during which time the required pressure is maintained before the test is started.
- .4 After completion of initial expansion phase, the pressure shall be at the required level, and the test period shall commence, this period must not exceed 2 hours.
- .5 After the test period, a measured amount of make up water shall be added to return the pipe to test pressure.
- .6 The amount of make up water shall not exceed the following:

Allowance for Expansion
(Litres/100 metres of pipe)

Nominal Pipe Size (mm)	1-Hour Test	2-Hour Test
75	1.24	2.48
100	2.48	3.73
150	3.73	6.21
200	6.21	12.42
250	9.94	16.15
300	13.66	28.56
350	17.39	34.77
400	21.11	40.98
450	27.32	53.40
500	34.77	68.31

- .7 Under no circumstances should the total time under test exceed 6 hours at 1.5 times the pressure rating.
 - 1 If the test is not complete due to leakage or equipment failure, the test section should be permitted to “relax” for 12 hours prior to the next testing sequence.
- .8 If any test of the pipe requires more makeup water than the allowance specified, the Contractor shall locate and repair the cause of the leakage and retest the line.
- .9 All visible leaks are to be repaired regardless of the amount of leakage.
- .10 The period of maintenance will not commence until all pipe lengths have pass such a test.

1. GENERAL

This Section specifies requirements for supplying and installing water, sanitary, and storm service connections.

1.1 Related Work

- | | | |
|----|-------------------------------------|------------------|
| .1 | Cast-In-Place Concrete | Section 03 30 20 |
| .2 | Trench Excavation and Backfilling | Section 31 23 16 |
| .3 | Construction Specification Drawings | Division 50 |

1.2 Scheduling of Work

- .1 Schedule work to minimize interruptions to existing services.
- .2 Maintain existing flow during construction.
- .3 Submit schedule of expected interruptions to the Engineer for approval and adhere to approved schedule.

2. PRODUCTS

2.1 Water Service Connections

- .1 Copper tubing to ASTM B88M, Type K, annealed.
- .2 Polyethylene municipal tubing, PE 3406, Series 160 to CAN3-B137.1.
- .3 Copper pipe joints to be of compression type suitable for 1035 kPa working pressure.
- .4 Polyethylene joints to be thermal butt fusion welded, or by use of compression fittings.
- .5 Brass components in contact with potable water must be made from either CDA?UNS Brass Alloys C89520 or C89833 with a maximum lead content of 0.25% by weight. These fittings may also be referred to as lead free.
- .6 Brass corporation stops: ball valve to AWWA C800, red brass to ASTM B62, having AWWA C800 inlet threads and compression outlet for use with copper or copper size polyethylene. AY McDonald 4701 B-22, Cambridge Brass 301 AxHx, Ford FB 1000, Mueller B-25008 or approved equal.
- .7 Brass curb stops: ball valve to AWWA C800, red brass to ASTM B 62, compression type. AY McDonald 6100-22, Cambridge Brass 202 HxHx, Ford B44-xxx, Mueller B-25209, or approved equal. Inlet and outlet to have compression joint fittings for use with copper or copper size polyethylene. To be

supplied complete with compatible curb stop chair.

- .8 Water service saddles: AWWA C800 thread, nylon coated, ductile iron body, double stainless steel strap for 38 mm and 50 mm.
- .9 Service box for 25.4 mm or smaller curb stops.
 - .1 Adjustable sliding top section, standard black iron pipe, with threaded top.
 - .2 Top section to be 610 mm in length, have a minimum 35.1 mm I.D., and a 10 mm set screw.
 - .3 2.44 m to 2.74 m bury.
 - .4 Threaded steel cap with slotted top, 19 mm pentagon brass plug.
 - .5 Casing - standard black iron pipe, 33.4 mm O. D.
 - .6 T-304 stainless steel rod, 12.7 mm diameter by 2.15 m long, complete with standard pigtail for 25 mm I.D. pipe and welded bottom bracket with an 8 mm cored hole.
 - .7 Rod to be complete with a 6 mm diameter cotter pin a minimum of 55.2 mm long.
 - .8 Box bottom boot is to be cast or ductile iron, factory coated, with a clear opening a minimum of 90 mm wide x 90 mm deep, to allow curb stop access.
 - .9 The boot is to attach to the casing by means of a threaded joint.
- .10 Service box for curb stops either 38 mm or 50 mm in size.
 - .1 Adjustable sliding top section, standard black iron pipe, with threaded top.
 - .2 Top section to be 610 mm in length, have a minimum 35.1 mm I.D., and a 10 mm set screw.
 - .3 2.44 m to 2.74 m bury.
 - .4 Threaded steel cap with slotted top, 19 mm pentagon brass plug.
 - .5 Casing - standard black iron pipe, 33.4 mm O. D.
 - .6 T-304 stainless steel rod, 12.7 mm diameter by 2.15 m long, complete with standard pigtail for 25 mm I.D. pipe and welded bottom bracket with an 8 mm cored hole.

- .7 Rod to be complete with a 6 mm diameter cotter pin a minimum of 57.2 mm.
- .8 Box bottom boot is to be cast or ductile iron, factory coated, with a clear opening a minimum of 129 mm wide x 115 mm deep, to allow curb stop access.
- .9 The boot is to attach to the casing by means of a threaded joint.

2.2 Sanitary and Storm Service Connections

- .1 Polyvinyl chloride SDR28 to CSA B182.1 with push-on joints. Sanitary and storm services shall be any colour except blue.
- .2 Service saddles: manufactured tee saddles, gasket type joints, secured with double stainless steel straps.
- .3 Polyvinyl chloride gasketed fittings to CAN-B182.1.
- .4 Inserta Tees: P.V.C. Hub to CAN-B182.1, rubber sleeve and gasket to ASTM F477.
- .5 Unless noted otherwise, sanitary services shall be 150 mm diameter with a 150 mm to 100 mm reducer installed at termination, storm services shall be 100 mm diameter.
- .6 Where a new service connecting joins an existing main aftermarket (e.g. site re-development in the downtown), a polyurethane based fitting with the ability to create a sealed joint at the connection may be used (e.g. IPEX Uni-T fitting). This type of fitting will not be allowed in new subdivision construction. This connection is not to be used with concrete pipe.

2.3 Insulation

- .1 If required, in locations as shown on drawings pipe shall be field insulated with extruded polystyrene board, Type HI-40 or approved equal as detailed.

3. EXECUTION

3.1 Preparation

- .1 Notify all consumers in writing at least 24 hours prior to any anticipated interruptions in their water service. Where possible schedule interruptions to occur in non-peak hours. If interruption is to last longer than eight hours provide temporary water service to each house using surface hoses connected to outside taps of each house.
- .2 Clean pipes and fittings of accumulated debris and water before installation.

Carefully inspect materials for defects. Remove defective materials from site.

3.2 Trenching, Bedding, and Backfill

- .1 Do trenching, bedding, and backfill work to Section 31 23 16 – Trench Excavation and Backfilling.
- .2 Trench alignment and depth as indicated by the Engineer.
- .3 Do not backfill trenches until installed work has been inspected by the Engineer.

3.3 Water Service Connections

- .1 Building water service to terminate at location shown on drawings opposite point of connection to main. Install coupling necessary for connection to building plumbing. If plumbing is already installed, make connection, otherwise cap or seal end of pipe and place temporary marker to locate pipe end.
- .2 Construct service connections at right angles to water main unless otherwise directed. Locate curb stops at location shown on drawings.
- .3 Employ only competent workmen equipped with suitable tools to carry out tapping of mains.
- .4 Tap main at 10:00 o'clock or 2:00 o'clock position only, not closer to a joint nor closer to adjacent service connections than recommended by manufacturer, or 1 m, whichever is greater.
- .5 Leave corporation stop valves fully open.
- .6 In order to relieve strain on connections, install service pipe in "goose neck" form "laid over" into horizontal position to the right facing the main. Service to be "snaked" in trench.
- .7 Install curb stop on services 50 mm or less in diameter. Leave curb stop valves fully closed.
- .8 Install service box, adjust to design elevation, and tighten set screw securely.
- .9 Place temporary markers at ends of service lines as shown on Drawing 50.04.01 in Division 50.

3.4 Sanitary and Storm Service Connections

- .1 Install pipe to CSA B182.1 and manufacturer's standard instructions and specifications.
- .2 Use saddles or tees approved by the Engineer for service connections to main sewer. Do not use break-in and mortar patch-type joints.

- .3 Service connection pipe shall not extend into interior of main sewer.
- .4 Make up required horizontal and vertical bends from 45° bends or less, separated by a straight section of pipe with a minimum length of four pipe diameters. Use long sweep bends where applicable.
- .5 Plug service laterals with watertight caps or plugs as approved. Paint last 1 m of sanitary red and storm green.
- .6 Pipe shall be laid straight and true at a minimum grade of 2%. No horizontal bends will be allowed unless approved by the Engineer.
- .7 Lay sanitary and/or storm services in same trench with water service. Install sanitary service on left side of water and storm on right side as viewed from main towards property line.
- .8 Install sanitary service inspection sampling chambers at locations shown on the Drawings.

3.5 Inspection

- .1 All service connections must be inspected and as-built by the Engineer prior to backfilling.

1. GENERAL

This Section specifies requirements for supplying and installing corrugated steel pipe culverts.

1.1 Related Work

- .1 Trench Excavation and Backfilling Section 31 23 16

2. PRODUCTS**2.1 Corrugated Steel Pipe**

- .1 Corrugated steel pipe (CSP), structural plate corrugated steel pipe (SPCSP) and couplers to CSA G401.
- .2 Provide watertight cut-off collars and gaskets as indicated.
- .3 Prefabricated end sections as indicated.
- .4 Bolts, nuts, and washers to ASTM A307, hot dip galvanized to CSA G164.

3. EXECUTION**3.1 Trenching, Bedding, and Backfill**

- .1 Do trenching, bedding, and backfill work to Section 31 23 16 – Trench Excavation and Backfilling.
- .2 Trench line and grade as established by the Engineer.
- .3 Do not backfill until pipe grade and alignment is inspected by the Engineer.

3.2 Laying Corrugated Steel Pipe Culverts

- .1 Commence pipe placing at downstream end.
- .2 Lay pipe with outside circumferential laps facing upstream and longitudinal laps or seams at side or quarter points.
- .3 Ensure bottom of pipe is in contact with shaped bed or compacted fill throughout its length.
- .4 Do not allow water to flow through pipes during construction except as permitted by the Engineer.

3.3 Joints

- .1 Corrugated Steel Pipe
 - .1 Match corrugations or indentations of coupler with pipe sections before

tightening.

- .2 Tap couplers firmly as they are being tightened to take up slack and ensure a snug fit.

- .3 Insert and tighten bolts.

.2 Structural Plate

- .1 Erect in final position by connecting plates with bolts at longitudinal and circumferential seams.
- .2 Drift pins may be used to facilitate matching of holes.
- .3 Place plates in sequence recommended by manufacturer with joints staggered so that not more than three plates come together at any one point.
- .4 Draw bolts up tight, without overstress, before beginning backfill.
- .5 Repair spots where damage has occurred to spelter coating by applying two coats of approved asphalt paint or two coats of zinc rich epoxy paint.

1. GENERAL

This Section specifies requirements for supplying and installing storm sewer pipe.

1.1 Related Work

.1	Basic Concrete Materials and Test Methods	Section 03 05 13
.2	Trench Excavation and Backfilling	Section 31 23 16
.3	Manholes and Catchbasins	Section 33 05 12
.4	Water, Sanitary and Storm Service Connections	Section 33 41 16
.5	Boring or Jacking Conduits	Section 33 71 15
.6	Construction Specification Drawings	Division 50

1.2 Scheduling of Work

- .1 Schedule work to minimize interruptions to existing services.
- .2 Maintain existing flow during construction.
- .3 Submit schedule of expected interruptions to the Engineer for approval and adhere to approved schedule.

2. PRODUCTS

2.1 Concrete Pipe

- .1 Sulphate resistant (Type HS) pipe.
- .2 Non-reinforced circular concrete pipe and fittings to ASTM C14 designed for flexible rubber gasket joints to ASTM C443.
- .3 Reinforced circular concrete pipe and fittings to ASTM C76 designed for flexible rubber gasket joints to ASTM C443.
- .4 Lifting Holes
 - .1 Pipe 900 mm and less in diameter, no lift holes.
 - .2 Pipe greater than 900 mm in diameter, lift holes not to exceed two in a piece of pipe.
 - .3 Provide prefabricated plugs to effectively seal lift holes after installation of pipe.

2.2 Plastic Pipe

- .1 All 200 mm storm sewer pipe shall be P.V.C. SDR35.
- .2 PVC pipe accepted to maximum size of 1200 mm; to meet CSA B182.4.
- .3 Polyvinyl Chloride (PVC) to ASTM D3034, CAN3-B182.1, and CAN3-B182.2.
 - .1 Standard dimensional ratio (SDR), 35.
 - .2 Separate gasket and integral bell system.
 - .3 All joints to meet requirements of specification for joints for drain and sewer plastic pipes using flexible elastomeric seals (ASTM 03212).
- .4 Ultra-rib PVC pipe and fittings to meet CSA B182.4, ASTM F794 and Uni-Bell Uni-B-9.
 - .1 Minimum pipe stiffness to be 320 kPa as measured in accordance with ASTM Standard D2412.
 - .2 Gaskets shall be as designed for Ultra-rib pipe and shall meet the requirements of ASTM F477.
- .5 Royal Kor-Flo PVC pipe and fittings to meet CSA 182.4, ASTM F794 and Uni-bell Uni-B-9.
 - .1 Minimum pipe stiffness to be 320 kPa as measured in accordance with ASTM Standard D2412.
 - .2 Gaskets shall be as designed for Royal Kor-Flo pipe and shall meet the requirements of ASTM F477.
- .6 Armtec's Boss 2000 Corrugated HDPE pipe and fittings to meet CSA B182.8.
 - .1 Minimum pipe stiffness to be 320 kPa as measured in accordance with ASTM Standard D2412.
 - .2 Watertight Bell and Elastomeric Gaskets shall be used on all pipe joints.
 - .3 Couplers and gaskets used to be specific for this product.
 - .4 No recycled resins to be permitted in the manufacture of this product.
- .7 May be any colour except blue.

2.3 Galvanized Corrugated Steel Pipe

- .1 Pipe to comply with CSA CAN3-G-401-M

- .2 Pipe diameter and class as shown on Drawings
- .3 All fittings to be suitable for corrugated steel pipe

2.4 Cement Mortar

- .1 Portland cement to CAN3-A3001, high sulphate resistant (Type HS).
- .2 Mortar to consist of one part Portland cement to two parts clean, sharp sand mixed with minimum amount of water to obtain optimum consistency for use intended. Do not use additives.
- .3 Refer to section 03 05 13 – Basic Concrete Materials and Test Methods.

3. EXECUTION

3.1 Preparation

- .1 Clean pipes and fittings of debris and water before installation. Carefully inspect materials for defects before installing. Remove defective materials from site.

3.2 Trenching, Bedding, and Backfilling

- .1 Do trenching, bedding, and backfill work in accordance with Section 31 23 16 – Trench Excavation and Backfilling.
- .2 Trench line and depth as established by the Engineer.

3.3 Installation

- .1 Lay and join pipe in accordance with manufacturer's recommendations.
- .2 Handle pipe by approved methods. Do not use chains or cables passed through rigid pipe bore so that weight of pipe bears upon pipe ends.
- .3 Lay pipes on prepared bed, true to line and grade with pipe inverts smooth and free of sags or high points. Ensure barrel of each pipe is in contact with shaped bed throughout its full length.
- .4 Commence laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.
- .5 Do not exceed maximum joint deflection or maximum bending radius recommended by pipe manufacturer.
- .6 Do not allow water to flow through pipes during construction except as may be permitted by the Engineer.

- .7 Whenever work is suspended, install removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
- .8 Position and join pipes by approved methods. Do not use excavating equipment to force pipe sections together.
- .9 Pipe Jointing
 - .1 Install gaskets as recommended by manufacturer.
 - .2 Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.
 - .3 Align pipes carefully before joining.
 - .4 Maintain pipe joints free from mud, silt, gravel and other foreign material.
 - .5 Avoid displacing gasket or contaminating with dirt or other foreign material. Remove disturbed or dirty gaskets; clean, lubricate and replace before joining is attempted.
 - .6 Complete each joint before laying next length of pipe.
 - .7 Minimize joint deflection after joint has been made to avoid joint damage.
 - .8 Apply sufficient pressure in making joints to ensure that joint is complete as outlined in manufacturer's recommendations.
- .10 When any work stoppage occurs, block pipes as directed to prevent "creep" during down time.
- .11 Plug lifting holes with approved prefabricated plugs set in non-shrink grout.
- .12 Cut pipes as required for special inserts, fittings or closure pieces in a neat manner, as recommended by pipe manufacturer, without damaging pipe or its coating and to leave a smooth end at right angles to axis of pipe.
- .13 Make watertight connections to manholes and catch basins. Use non-shrink grout when suitable gaskets are not available.

3.4 Boring and Jacking

- .1 Refer to Section 33 71 15 - Boring or Jacking Conduits.

3.5 Service Connections

- .1 Refer to Section 33 41 16 - Water, Sanitary and Storm Service Connections.

3.6 Testing

.1 Camera Testing

- .1 All storm mains are to be inspected using closed circuit television with a copy of the report and video forwarded to the Town. Any defects identified are to be corrected at the Contractor's expense.
- .2 The Construction Completion Certificate for storm mains will not be issued until the camera inspection report is complete and approved by the Engineer.

.2 Alignment and Grade

- .1 Sewer main will be checked for alignment by the Engineer during construction. Any deviation from design alignment greater than 50 mm shall be corrected prior to backfilling.
- .2 Sewer main design grade to be maintained as directed by the Engineer. Any apparent discrepancies are to be reported immediately. Grade to be continuous through manhole. Invert elevation shall be within 50 mm of design elevation at manholes.

.3 Visual Inspection

- .1 Sewer mains shall be tested by means of a light test. For satisfactory alignment, illuminated interior of pipe shall not show any substantial misalignments of pipes or gaskets nor other defects. On large diameter pipes where light test not effective, pipe interior shall be inspected by walking through pipe.
- .2 Any defects located shall be repaired at the Contractor's expense as directed by the Engineer.

1. GENERAL

This Section specifies requirements for supplying and installing sub-drain systems for roadways or other specified applications.

1.1 Related Work

.1	Aggregates Materials	Section 31 05 17
.2	Trench Excavation and Backfilling	Section 31 23 16
.3	Geotextiles	Section 31 32 21

2. PRODUCTS

2.1 Pipe

- .1 Perforated PVC pipe shall be 150 mm diameter IPEX Inc. PERF SDR35 or approved equal and shall meet the following requirements:
 - .1 CAN3-B182.1 and ASTM D3034.
 - .2 Perforations shall consist of two rows of 14 mm holes positioned at 120° radially and spaced to provide a minimum total cross sectional hole area of 3000 mm² per metre of length.
 - .3 Pipes shall be fit with friction fit bell ends.
- .2 Perforated corrugated steel pipe and couplers to meet following requirements:
 - .1 CAN3-G-401.
 - .2 Galvanized.
 - .3 Metal thickness unless otherwise indicated:

<u>Diameter</u>	<u>Thickness of Metal</u>
150 to 200 mm	1.2 mm
250 to 300 mm	1.6 mm

2.2 Granular Filter Material

- .1 Screened rock to Section 31 05 17 – Aggregate Materials.

2.3 Geotextile Fabric

- .1 Geotextile fabric to Section 31 32 21 – Geotextiles.

- .2 Geotextile fabric sleeve: Hilex Nu-Drain Type A; or approval equal.

3. EXECUTION

3.1 Trenching

- .1 Do trenching and backfill work to Section 31 23 16 – Trench Excavation and Backfilling.
- .2 Trench line and depth as established by the Engineer.

3.2 Bedding

- .1 Trim drain bed to given elevations.
- .2 Correct over excavation with approved material compacted to not less than 100% of Standard Proctor Density.

3.3 Installation

- .1 Drape filter cloth material in trench.
- .2 Place minimum of 75 mm of screened rock on trench bottom.
- .3 Lay drains on prepared bed, true to line and grade with inverts smooth and free of sags or high points. Ensure barrel of each pipe is in contact with bed throughout full length.
- .4 Commence laying at outlet and proceed in upstream direction.
- .5 Wrap pipe with geotextile fabric or insert pipe in geotextile sleeve as shown on the drawings as directed by the Engineer.
- .6 Lay perforated pipes with perforations downwards.
- .7 Make joints in accordance with manufacturer's instructions.
- .8 Do not allow water to flow through pipes during construction except as approved.
- .9 Place filter rock over drainage pipe to the depth shown in contract drawings.
- .10 Wrap filter material around top of filter rock. Ensure ends overlap a minimum of 300 mm.
- .11 Protect sub-drains against flotation during installation.
- .12 Connect sub-drains to manhole as indicated.

3.4 Backfilling

- .1 Do not backfill until system is inspected by the Engineer.
- .2 Backfill with specified material using hand tampers.

1. GENERAL

This Section specifies requirements for supplying and installing catchbasin leads.

1.1 Related Work

- | | | |
|----|-----------------------------------|------------------|
| .1 | Trench Excavation and Backfilling | Section 31 23 16 |
|----|-----------------------------------|------------------|

2. PRODUCTS

2.1 Plastic Pipe

- | | |
|----|---|
| .1 | Ultra-Rib PVC pipe and fittings to meet CSA B182.4, ASTM F794 and Uni-bell Uni-B-9 having a diameter of 250 mm. |
| .2 | Royal Kor-Flo PVC pipe and fittings to meet CSA 2.4, ASTM F949 and Uni-bell Uni-B-9. |
| .3 | Minimum pipe stiffness to be 320 kPa as measured in accordance with ASTM D2412. |
| .4 | Gaskets to be designed for Ultra-Rib PVC pipe and shall meet ASTM F477. |
| .5 | Pipe diameter to be 250 mm or greater. |
| .6 | Any colour except blue. |

2.2 Corrugated Metal Pipe

- | | |
|----|--|
| .1 | Corrugated steel pipe: 1.6 mm wall thickness conforming to CSA G401 having a minimum diameter of 250 mm. |
| .2 | Provide watertight couplers, with rubber gasket conforming to ASTM C361M and CSA G401. |

3. EXECUTION

3.1 Trenching, Bedding, and Backfill

- | | |
|----|---|
| .1 | Trenching, bedding, and backfill to Section 31 23 16 – Trench Excavation and Backfilling. |
| .2 | Trench line and grade as established by the Engineer. |
| .3 | Do not backfill until pipe grade and alignment inspected by the Engineer. |

3.2 Laying Catchbasin Lead

- | | |
|----|-----------------------------|
| .1 | Commence laying at manhole. |
|----|-----------------------------|

- .2 Lay and join pipe in accordance with manufacturer's recommendations.
- .3 Ensure bottom of pipe is in contact with shaped bed throughout its length.
- .4 Do not allow water to flow through pipes during construction except as permitted by the Engineer.

3.3 Joints

- .1 Install rubber gaskets and couplers in accordance with manufacturer's instructions.

3.4 Connection to Catchbasins and Manholes

- .1 Break out opening to suit pipe diameter.
- .2 Cut pipe to conform to inside wall of manhole or catchbasin.
- .3 Grout pipe in place.
- .4 Encase first 0.5 m of pipe in concrete. Thickness of encasement to be one half pipe diameter or 150 mm, whichever is greater.

1. GENERAL

This Section specifies requirements for excavation of pits, jacking and tunnelling, installation of pipe, and backfilling and installation of casing, if required, for crossings.

1.1 Related Work

.1	Traffic Control	Section 01 35 14
.2	Cast-In-Place Concrete	Section 03 30 20
.3	Trench Excavation and Backfilling	Section 31 23 16
.4	Water Mains	Section 33 11 17
.5	Sanitary Sewer Mains	Section 33 31 13
.6	Sewage Force Mains	Section 33 34 00
.7	Storm Sewer Mains	Section 33 44 00

1.2 Safety Requirements

- .1 Adhere to Municipal and Provincial requirements relating to safety of trenching work, including shoring and bracing as required.
- .2 Adhere to all crossing permit (railway, pipeline, telecommunications duct, etc.) requirements.
- .3 Provide barricades, flares, etc. to adequately denote area of excavation adjacent to roadways. Refer to Section 01 35 14 – Traffic Control.
- .4 Cover ends of casing pipe if carrier pipe is not installed immediately following jacking or tunnelling.

2. PRODUCTS

2.1 Materials

- .1 Casing pipe shall be manufactured according to ASTM A53 for seamless or spiral weld pipe. Minimum wall thickness shall be 9.5 mm.

3. EXECUTION

3.1 Excavation

- .1 Where designated on drawings install main by jacking or tunnelling. A casing will be permitted if soil conditions dictate.

- .2 Excavated working pit shall be dug to minimum dimensions that meet regulation and shall be kept dewatered during construction of crossing.
- .3 Carrier pipe shall be installed to line and grade set out on drawings.
- .4 Casing pipe shall not be in tension and joints shall be welded type.
- .5 If casing is utilized, carrier pipe shall be strapped with approved blocking to ensure that carrier pipe is supported along its entire length.
- .6 Join carrier pipe one length at a time outside hole or casing and push carrier pipe into position. Carrier pipe susceptible to breakage to be strapped at joints to prevent possibility of over pushing of joints.
- .7 Carrier pipe shall be cradled on fill concrete at each end of casing pipe. Concrete shall be poured in ends of casing pipe to form a watertight seal.

Section 34 71 15

Concrete Barriers

Section 34 71 34

Steel W-Beam Guide Rail

1. GENERAL

This Section specifies cast-in-place or precast “New Jersey” or similar concrete barriers for medians and roadsides.

1.1 Related Work

.1	Basic Concrete Materials and Test Methods	Section 03 05 13
.2	Concrete Formwork	Section 03 10 00
.3	Concrete Reinforcement	Section 03 20 10
.4	Cast-In-Place Concrete	Section 03 30 20
.5	Trench Excavation and Backfilling	Section 31 23 16
.6	Roadway Embankment and Compaction	Section 31 24 13
.7	Granular Sub-Base	Section 32 11 19
.8	Granular Base	Section 32 11 23

2. PRODUCTS

2.1 Materials

- .1 External connectors
 - .1 Steel as indicated.
 - .2 Galvanizing to CAN/CSA G164, minimum zinc coating.
- .2 Reinforcement to Section 03 20 10 – Concrete Reinforcement, with the following requirements:
 - .1 Epoxy coated deformed bars, grade as specified by the Engineer.
 - .2 Wire mesh, grade as specified by the Engineer.
- .3 Concrete mixes and materials to Section 03 05 13 Basic Concrete Materials and Test Methods.
- .4 Granular base to Section 32 11 23 – Granular Base.
- .5 Curing compound to Section 03 30 20 – Cast-In-Place Concrete, Type 1-D or Type 2.
- .6 Expansion joint filler to ASTM D1751, preformed non-extruding resilient

bituminous type.

.7 Boiled linseed oil to CAN/CGSB-1.2.

.8 Kerosene to CAN/CGSB-3.3.

3. EXECUTION

3.1 Preparation

.1 Do grading in accordance with Section 31 24 13 – Roadway Embankment and Compaction, and as indicated.

.2 Install granular base in accordance with Section 32 11 23 – Granular Base, and as indicated.

3.2 Construction

.1 Cast-In-Place Units

.1 Do forming in accordance with Section 03 10 00 – Concrete Formwork.

.2 Install reinforcement in accordance with Section 03 20 10 – Concrete Reinforcement.

.3 Concrete for cast-in-place units.

.4 Do concrete work in accordance with Section 03 30 20 – Cast-In-Place Concrete, and as specified herein.

.5 Construct expansion joints in locations and to details as indicated.

.6 Construct contraction joints at 6 m spacing by use of compressible insert or by sawing.

.1 Cut sawn contraction joints prior to final set and before uncontrolled cracking of barrier occurs, as directed by the Engineer.

.7 Round edges, including edges of joints, with 10 mm radius edging tool.

.8 Finish surfaces to within 3 mm in 3 m from line, level, or grade as measured with a straightedge placed on surface.

.2 Precast Units

.1 Do precast concrete work in accordance with Section 03 30 20 – Cast-In-Place Concrete.

- .2 Cast lifting devices into units.
 - .3 Provide minimum 100 mm cover over reinforcement.
 - .4 Use only inverted steel forms.
 - .5 Concrete to be without surface defects to approval of the Engineer. Finishing will not be permitted.
 - .6 Storage of precast units on site to be in single layer.
 - .7 Place concrete barrier units and make connections as indicated. Alignment to be smooth with no visible deviations.
- .3 Boiled linseed oil treatment for cast-in-place units.
- .1 After concrete has cured for specified curing time and when surface of concrete is dry, apply two coats of linseed oil mixture, consisting of one part linseed oil to one part kerosene, uniformly to surfaces of guide rails.
 - .1 First application is 135 ml/m² and second application is 90 ml/m². Allow coatings to thoroughly dry prior to applying second or subsequent coatings.
 - .2 Treat all sawn joints with linseed oil mixture.
 - .3 Do not apply linseed oil mixture to damp surface.

1. GENERAL

This Section specifies requirements for supplying and installing steel W-beam guide rail for medians and roadsides.

2. PRODUCTS

2.1 Materials

- 1 Steel W-beam guide rail:
 - 1 Steel rail and terminal sections to AASHTO M180, Class A (Type 1 zinc coated).
 - 2 Bolts, nuts, and washers to ASTM A307, hot dip galvanized to CSA G164.
 - 3 Organic zinc-rich coating to CGSB 1-GP-181M.
 - 4 Sawn timber post and offset block:
 - 1 Construction grade lumber, pressure treated in accordance with CAN/CSA 080.0.
 - 2 Dimensions as indicated.

3. EXECUTION

3.1 Erection

- 1 Install posts plumb at locations and to depths as indicated or as directed by the Engineer.
- 2 Excavate post holes and compact bottom to provide firm foundation. Set post plumb and square in hole.
- 3 Backfill around post using excavated material and compact in uniform layers not exceeding 150 mm compacted thickness to ground elevation.
- 4 Cut off tops of posts as indicated.
- 5 Construct anchorages to details as indicated. Place and compact backfill for anchors as directed by the Engineer.
- 6 Erect steel W-beam components to details as indicated. Lap joints in direction of traffic. Tighten nuts to 100 N.m torque. Maximum protrusion of bolt 6 mm beyond nut.

3.2 Attachment to Concrete Structure

- .1 When the terminal point is attached to a concrete structure, install a galvanized C150 x 12 x 7.6 m long channel below the W-beam guide rail, as shown on the drawings.

3.3 Painting/Touch Up

- .1 Galvanized steel touch up:
 - .1 Clean damaged surfaces with wire brush removing loose and cracked coatings. Apply two coats of organic zinc-rich paint to damaged areas. Pretreat damaged surfaces according to manufacturer's instructions for zinc-rich paint.

DESCRIPTION	DRAWING
<u>Trench Excavation and Backfill</u>	
Utility Trench Backfill Class B Bedding	50.10.01
Class B Trench Bedding	50.10.02
Class B Trench Bedding	50.10.03
<u>Water Mains</u>	
Water Main Horizontal Thrust Blocks	50.20.01
Water Main Vertical Thrust Blocks	50.20.02
Hydrant Installation Detail	50.20.03
Type A Valve Box Assembly	50.20.04
Type B Valve Box Assembly	50.20.05
Air Relief Valve and Flushing Chamber	50.20.06
<u>Manholes and Catchbasins</u>	
Standard 1200mm Precast Manhole Assembly	50.30.01
Precast Pre-benched Bases for 1200mm Manhole Assembly	50.30.02
1 – S Precast Manhole Assembly	50.30.03
1500 – 3000mm Large Diameter Manhole Assembly	50.30.04
Interior Drop Sanitary Manhole	50.30.05
Precast Slab Tops for 1200mm Manholes	50.30.06
Sanitary and Storm Manhole Adjusting Collar	50.30.07
Manhole Safety Platform	50.30.08
Precast Catchbasin Assembly	50.30.09
1200mm Catchbasin Assembly	50.30.10
Twin Catchbasin and Catchbasin Manhole Assembly	50.30.11
Type K-1 Catchbasin and Catchbasin Manhole Top Assembly	50.30.12
Type K-3 Catchbasin and Catchbasin Manhole Top Section	50.30.13
Type K-4 Catchbasin and Catchbasin Manhole Top Section	50.30.14
Type K-6 Catchbasin and Catchbasin Manhole Top Section	50.30.15
Type K-7 Catchbasin and Catchbasin Manhole Top Section	50.30.16
Type DK-7 Catchbasin and Catchbasin Manhole Top Section	50.30.17
Trash Grate Catchbasin and Catchbasin Manhole Top Section	50.30.18
Typical Outlet Control Structure	50.30.19
Rip-Rap Culvert End Treatment	50.30.20
F-39 Standard Sanitary Sewer Manhole Cover	50.30.21
F-39 Standard Sanitary Sewer Manhole Frame	50.30.22
F-49 Standard Storm Sewer Manhole Frame	50.30.23
F-39 Sanitary Sewer Manhole Riser Frame	50.30.24
F-49 Storm Sewer Manhole Riser Frame	50.30.25
F-51 Catchbasin Grate Option 1	50.30.26
F-51 Catchbasin Grate Option 2	50.30.27

DESCRIPTION	DRAWING
F-51 Catchbasin Grate Option 3	50.30.28
F-51 Catchbasin Frame	50.30.29
F-51 Side Inlet	50.30.30
F-33 Catchbasin Grate	50.30.31
F-33 Catchbasin Frame	50.30.32
SK-7 Catchbasin Single Grate Frame	50.30.33
DK-7 Catchbasin Double Frame	50.30.34
K-7 Catchbasin Grate for Single or Double Frame	50.30.35
Trash Grate	50.30.36

Service Connections

Typical Residential Service Connection	50.40.01
Standard Top Adjustment Service Box and Boot for 25mm/38mm/50mm Service	50.40.02
Stainless Steel Service Box Rod	50.40.03
Service Box Cap	50.40.04

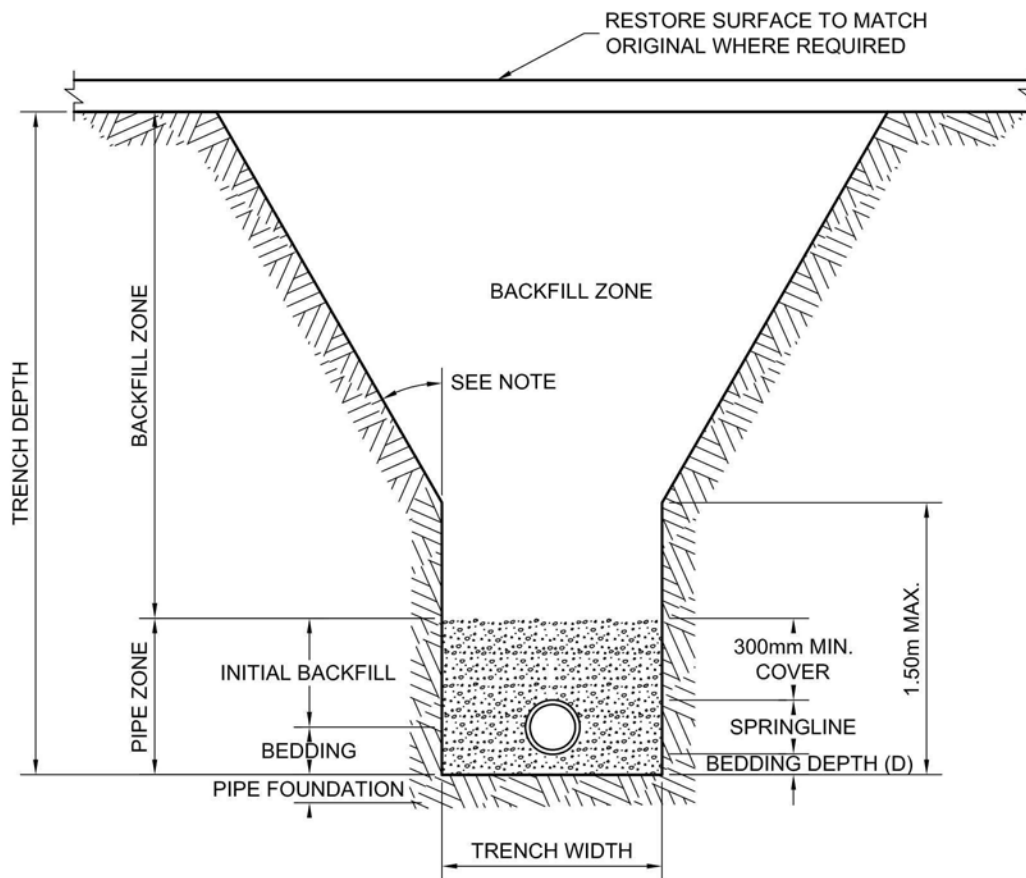
Concrete Work

Standard Monolithic Sidewalk	50.60.01
Rolled Monolithic Sidewalk	50.60.02
Separate Sidewalk with Standard Curb and Gutter	50.60.03
250mm Curb and Gutter	50.60.04
500mm Curb and Gutter for Arterial Roadways	50.60.05
500mm Reversed Curb and Gutter for Arterial Roadways	50.60.06
Pinned Concrete Curb	50.60.07
Curb and Gutter Widening for F-33 K-1 and DK-7 Catchbasin Installation	50.60.08
Typical Monolithic and Separate Lane Driveway Crossing	50.60.09
Typical Monolithic and Separate Paved Lane Crossing	50.60.10
1.5m Monolithic Sidewalk Paraplegic Ramp	50.60.11
2.5m Monolithic Sidewalk Paraplegic Ramp	50.60.12
Separate Sidewalk Paraplegic Ramp	50.60.13
Handformed and Extruded Separate Sidewalk Base Detail	50.60.14
Separate Sidewalk Adjacent to Existing Curb and Gutter	50.60.15
Concrete Doweling Detail for Sidewalk Replacement	50.60.16
Arterial Roadway Median	50.60.17
Collector and Local Roadway Medians	50.60.18
Drainage Swale	50.60.19
Drainage Swale into Boulevard Catchbasin	50.60.20

Miscellaneous Roadway Construction

Bollard Assembly	50.70.01
Knockdown Bollard Detail	50.70.02

DESCRIPTION	DRAWING
W-Beam Guardrail	50.70.03
Typical Section for Replacing Unsuitable Subgrade	50.70.04
Pavement Removal and Replacement Adjacent to a Curb	50.70.05
Post and Cable Fence	50.70.06



NOTE :

TRENCH EXCAVATION

- TRENCH TO BE SLOPED AS PER OCCUPATIONAL HEALTH & SAFETY ACT.
- IN HARD & COMPACT SOIL, TO NOT LESS THAN 30° FROM THE VERTICAL.
- IN OTHER SOILS TO NOT LESS THAN 45° FROM THE VERTICAL.

BACKFILL ZONE

- COMPACTION DENSITY SHALL BE MINIMUM 97% OF MAXIMUM DRY DENSITY OF THE STANDARD PROCTOR REPRESENTING THE SOIL PLACED.
- USE SUITABLE SITE MATERIAL OR IMPORTED MATERIAL FOR BACKFILL.
- MATERIAL SHALL BE PLACED IN A MAXIMUM OF 300mm LAYERS.

PIPE ZONE

INITIAL BACKFILL

- COMPACTION DENSITY SHALL BE A MINIMUM 100% OF MAXIMUM DRY DENSITY OF THE STANDARD PROCTOR REPRESENTING THE SOIL PLACED.
- USE MATERIAL SHOWN IN DRAWING "1.02".
- PLACE IN 150mm LAYERS AND COMPACT BOTH SIDES SIMULTANEOUSLY.

PIPE BEDDING

- COMPACTION DENSITY SHALL BE A MINIMUM 100% OF MAXIMUM DRY DENSITY OF THE STANDARD PROCTOR REPRESENTING THE SOIL PLACED.
- USE MATERIAL SHOWN IN DRAWING "1.02" UNLESS PIPE FOUNDATION IS UNSUITABLE.
- IF UNSUITABLE PIPE FOUNDATION IS ENCOUNTERED, USE 40mm SCREENED ROCK FOR THE BEDDING TO A MINIMUM DEPTH OF 400mm BELOW THE PIPE AND UP TO THE SPRINGLINE OF THE PIPE. USE FILTER FABRIC TO SEPARATE SUBGRADE MATERIAL AND BEDDING MATERIAL.

TRENCH WIDTH

FLEXIBLE (PVC) PIPE
AS PER PVC HANDBOOK

NOMINAL PIPE DIA. (mm)	MIN. TRENCH WIDTH (mm)
200	700
300	800
400	900
500	950
600 & larger	O.D. x 1.5

MAX. TRENCH WIDTH (mm)

350 & larger O.D. x 2.5

RIGID (CONCRETE) PIPE
AS PER CONCRETE HANDBOOK

MINIMUM TRENCH WIDTH = O.D. + 600mm

MAXIMUM TRENCH WIDTH AS
SPECIFIED BY THE ENGINEER.

(USED TO CALCULATE D 0.01 & TO
SPECIFY CLASS OF PIPE)

O.D. = OUTSIDE DIAMETER (mm)

THE TOWN OF SYLVAN LAKE

DRAWN BY:
D.K.

DATE:
JAN 2014

SCALE:
N.T.S.

CONSTRUCTION SPECIFICATION DRAWINGS
Trench Excavation and Backfill

UTILITY TRENCH BACKFILL
REQUIREMENTS
CLASS B BEDDING

APPROVED BY:

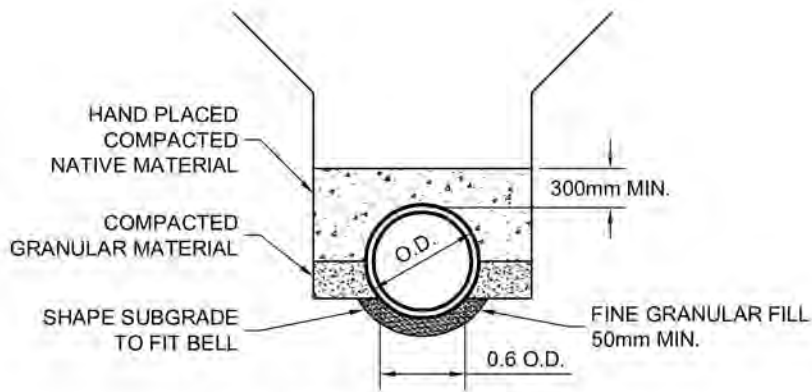
A.G.

DIRECTOR OF
PUBLIC WORKS

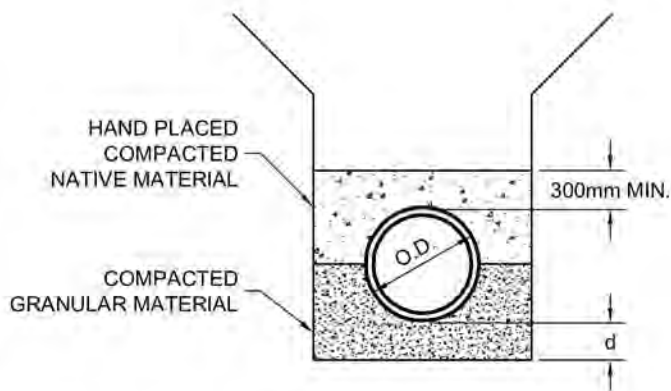
DRAWING NO.

50.10.01

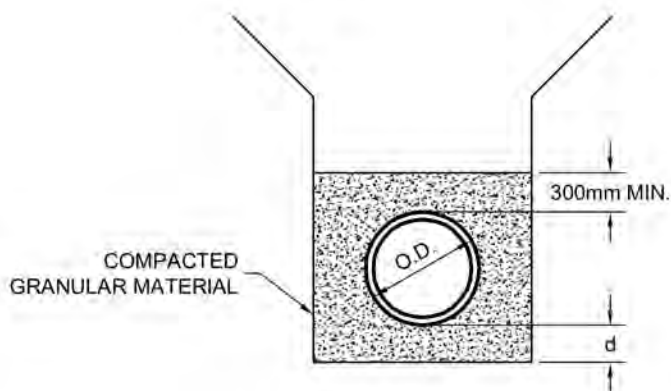
NO.	DATE	REVISION



SHAPED SUBGRADE WITH
GRANULAR FOUNDATION



GRANULAR FOUNDATION



GRANULAR SURROUND

NOTE :
SUBGRADE SHOULD BE EXCAVATED
OR OVER EXCAVATED SO A UNIFORM
FOUNDATION MAY BE PROVIDED. FREE
OF PROTRUDING ROCKS.

DEPTH OF MATERIAL BELOW PIPE	
Pipe Diameter D (mm)	Bedding Distance d (min.)
675 or SMALLER	75
750 to 1500	100
1650 or LARGER	150

THE TOWN OF SYLVAN LAKE

DRAWN BY:
D.K.

DATE:
JAN 2014

SCALE:
N.T.S.

CONSTRUCTION SPECIFICATION DRAWINGS
Trench Excavation and Backfill

CLASS B BEDDING
BEDDING DETAILS

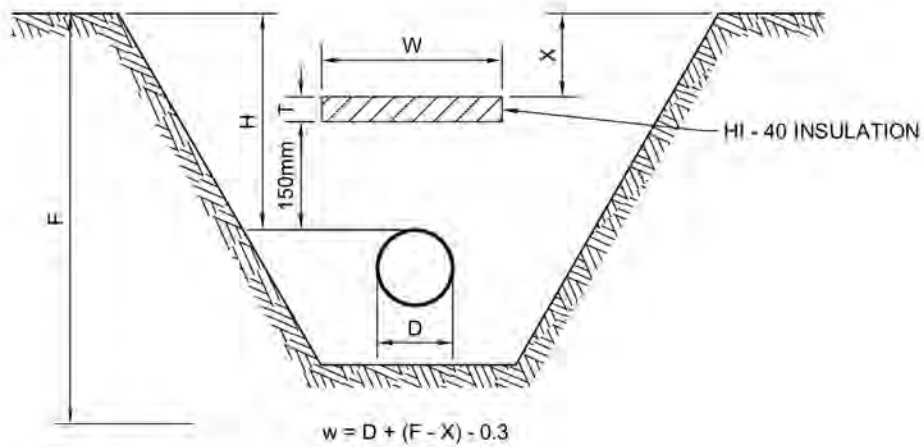
APPROVED BY:

A.G.

DIRECTOR OF
PUBLIC WORKS

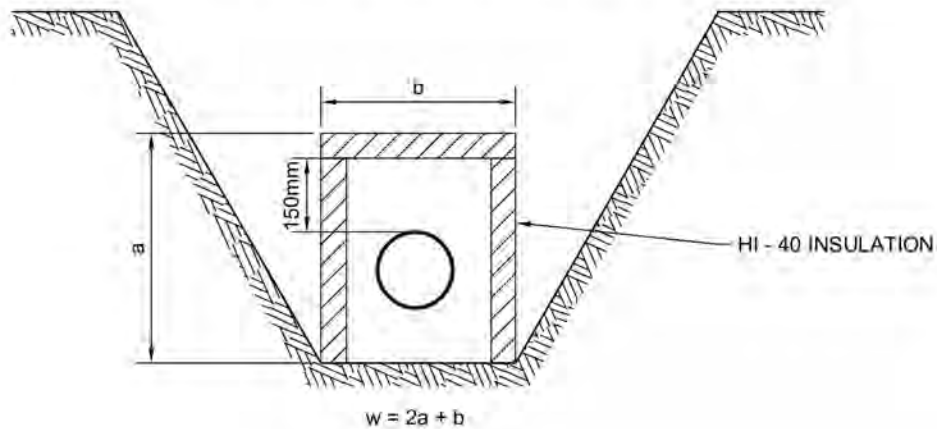
DRAWING NO.

50.10.02



HORIZONTAL LAYER

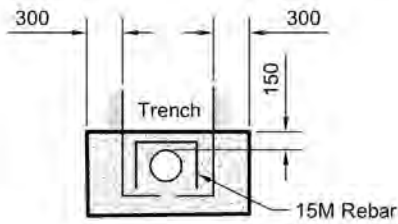
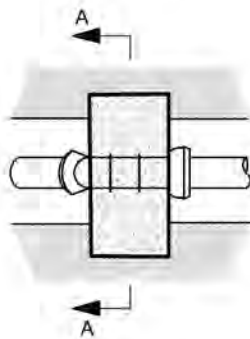
T = INSULATION THICKNESS (mm)
W = INSULATION WIDTH (m)
D = PIPE DIAMETER (M)
X = INSULATION DEPTH (m)
F = ESTIMATED FROST DEPTH (2.70m)



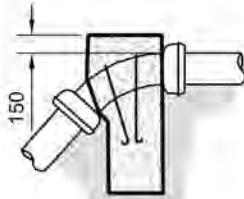
INVERTED U

DEPTH FROM FINISHED GRADE TO THE TOP OF INSULATION "X" (METERS)	0 - 1	1-1.25	1.25-1.50	1.50-1.80	1.80-2.10	2.10-2.40	2.40 or Greater
INSULATION THICKNESS "T" (mm)	N/A	65	50	40	25	25	0

			THE TOWN OF SYLVAN LAKE			
			DRAWN BY: D.K.	CONSTRUCTION SPECIFICATION DRAWINGS Trench Excavation and Backfill		APPROVED BY: <i>A.G.</i> DIRECTOR OF PUBLIC WORKS
			DATE: JAN 2014	TRENCH INSULATION DETAIL		DRAWING NO. 50.10.03
			SCALE: N.T.S.			
NO.	DATE	DESIGNED				



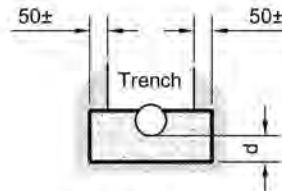
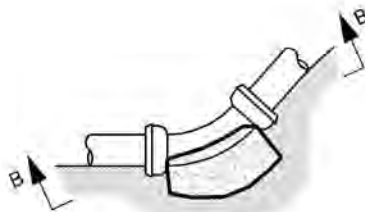
SECTION 'A - A'



VERTICAL DEAD WEIGHT THRUST BLOCK									
VOLUME OF CONCRETE (cu m)									
DEGREE OF BEND	SIZE OF BEND (mm)								
	150	200	250	300	350	400	500		
11 1/4	0.2	0.4	0.6	0.9	1.2	1.6	2.4		
22 1/2	0.4	0.8	1.2	1.7	2.3				
45	0.8	1.5	2.3						
90									



SPECIFIC DESIGN REQ'D. BY ENGINEER



SECTION 'B - B'

THRUST BLOCK BEARING AREA									
MINIMUM CONCRETE AREA IN CONTACT WITH UNDISTURBED SOIL (sq. m)									
DEGREE OF BEND	SIZE OF MAIN (mm)								
	150	200	250	300	350	400	500		
11 1/4°	0.07	0.12	0.20	0.28	0.38	0.50	0.78		
22 1/2°	0.14	0.24	0.38	0.55	0.75				
45°	0.27	0.48	0.75						
90°									



SPECIFIC DESIGN REQ'D. BY ENGINEER

NOTE :

- BEARING AREA CALCULATED USING THE FOLLOWING:
 - (a) HYDRAULIC PRESSURE 1380 kPa..
 - (b) SOIL BEARING CAPACITY 72 kPa..
- CONCRETE STRENGTH TO BE 20 MPa .
- CONCRETE TO BE CLEAR OF BELLS & PIPE.
- PLACE 6 ml POLYETHYLENE BETWEEN CONCRETE AND PIPE.
- SEE DWG. 1.02 FOR DEPTH VALUES.
- BOLD LINE REPRESENTS THE BEARING SURFACE.

THE TOWN OF SYLVAN LAKE

CONSTRUCTION SPECIFICATION DRAWINGS
Water Mains

WATER MAIN VERTICAL BEND
THRUST BLOCKS

APPROVED BY:

A.G.

DIRECTOR OF
PUBLIC WORKS

DRAWING NO.

50.20.02

DRAWN BY:

D.K.

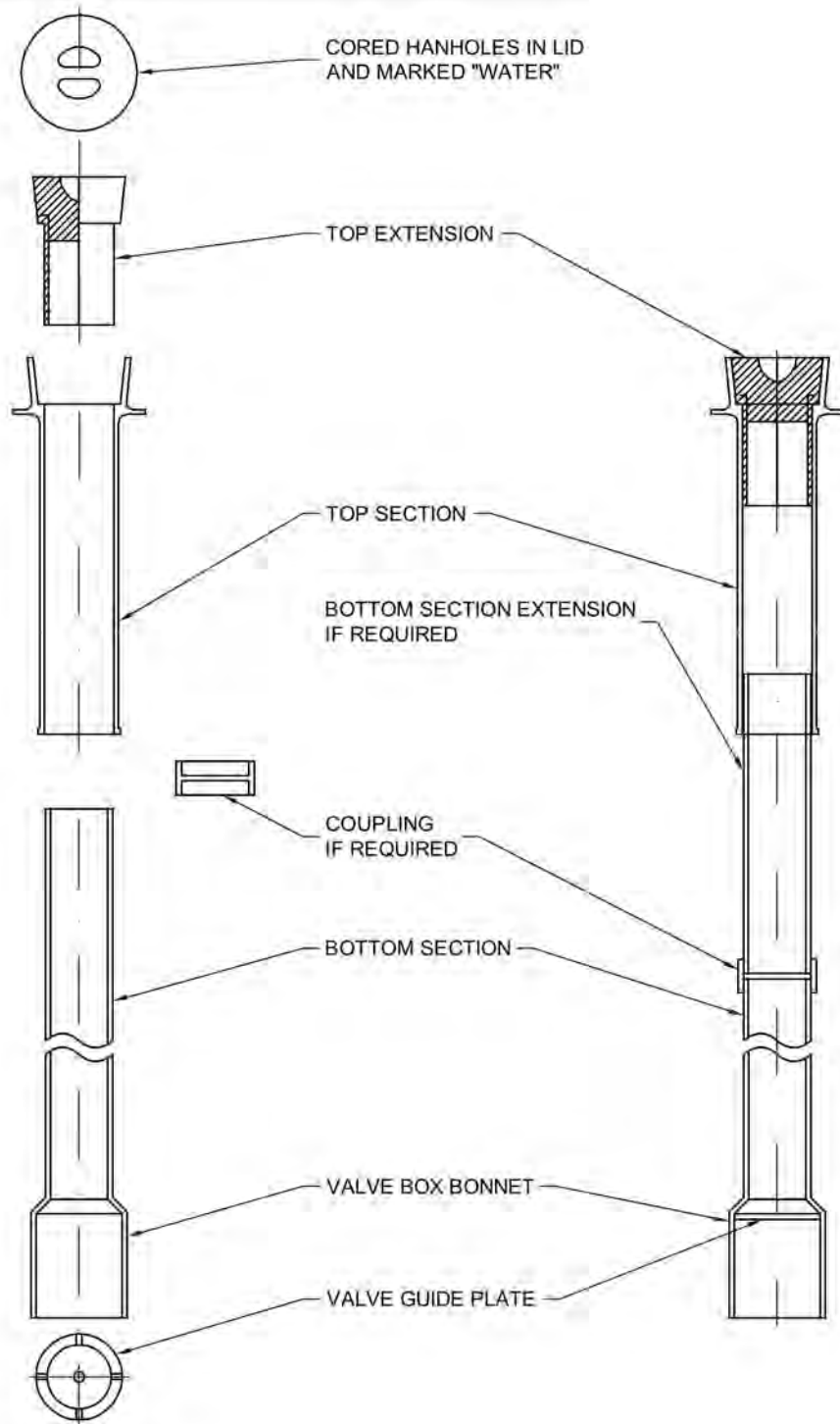
DATE:

JAN 2014

SCALE:

N.T.S.

NO. DATE REVISION




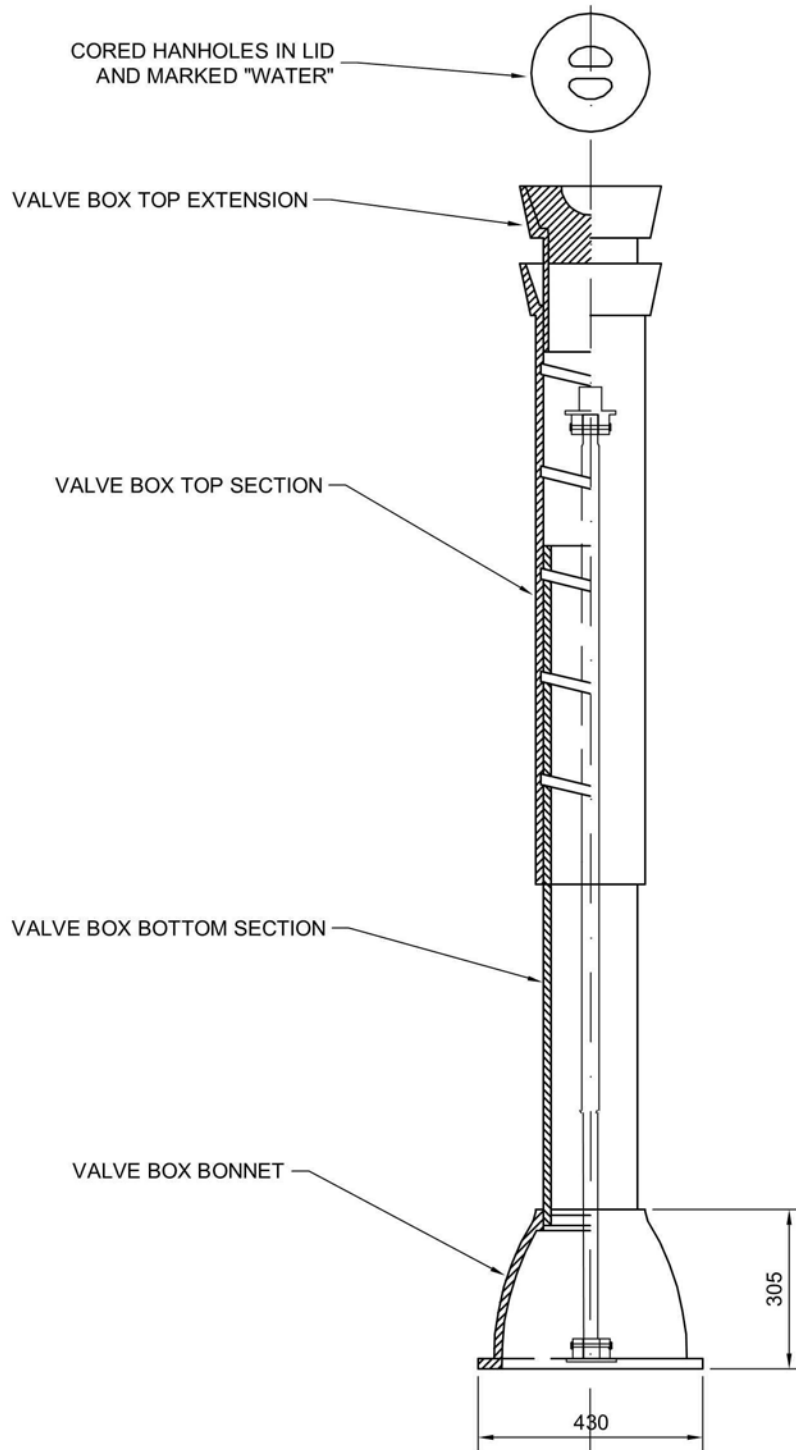
COMPONENTS

ASSEMBLY

NOTE:

- 763mm CAST IRON UPPER SECTION WITH PVC LOWER SECTION
- LOWER SECTION ALSO AVAILABLE IN CAST IRON

			THE TOWN OF SYLVAN LAKE		
			DRAWN BY: D.K.	CONSTRUCTION SPECIFICATION DRAWINGS Water Mains	APPROVED BY:  DIRECTOR OF PUBLIC WORKS
			DATE JAN 2014	TYPE "A" VALVE BOX ASSEMBLY	DRAWING NO. 50.20.04
			SCALE: N.T.S.		
NO.	DATE	REVISION			



TYPE 'B'
SCREW ASSEMBLY

NOTE :

- VALVE BOXES ARE ALL CAST IRON AND
ARE SUPPLIED COMPLETELY COATED WITH
AN ASPHALTIC TYPE VARNISH TO PREVENT
CORROSION

THE TOWN OF SYLVAN LAKE

DRAWN BY:
D.K.

CONSTRUCTION SPECIFICATION DRAWINGS
Water Mains

APPROVED BY:

DATE:
JAN 2014

TYPE "B" VALVE BOX
ASSEMBLY

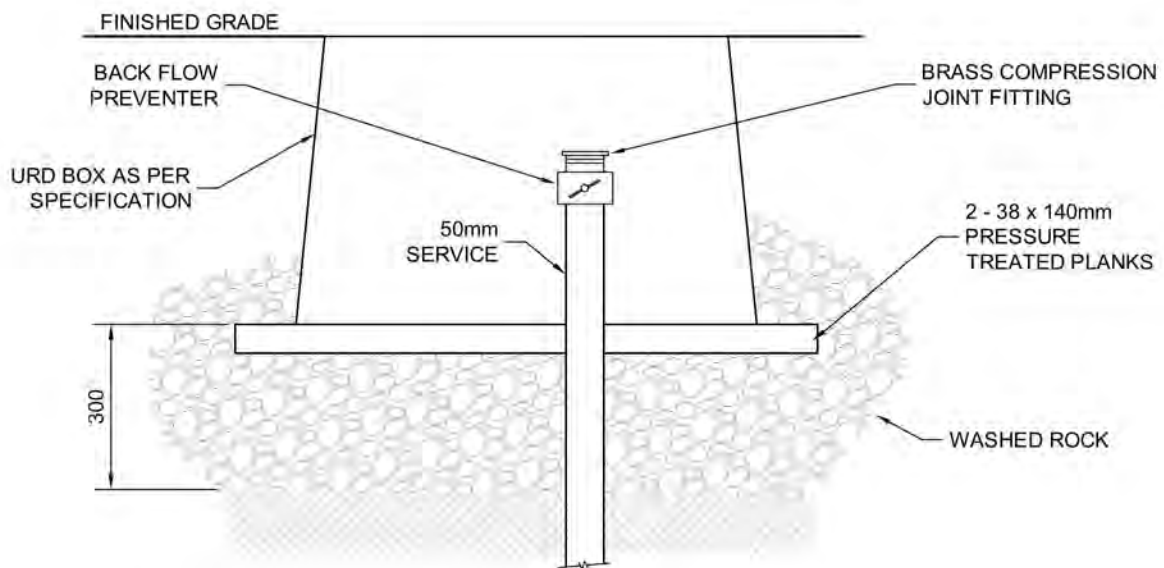
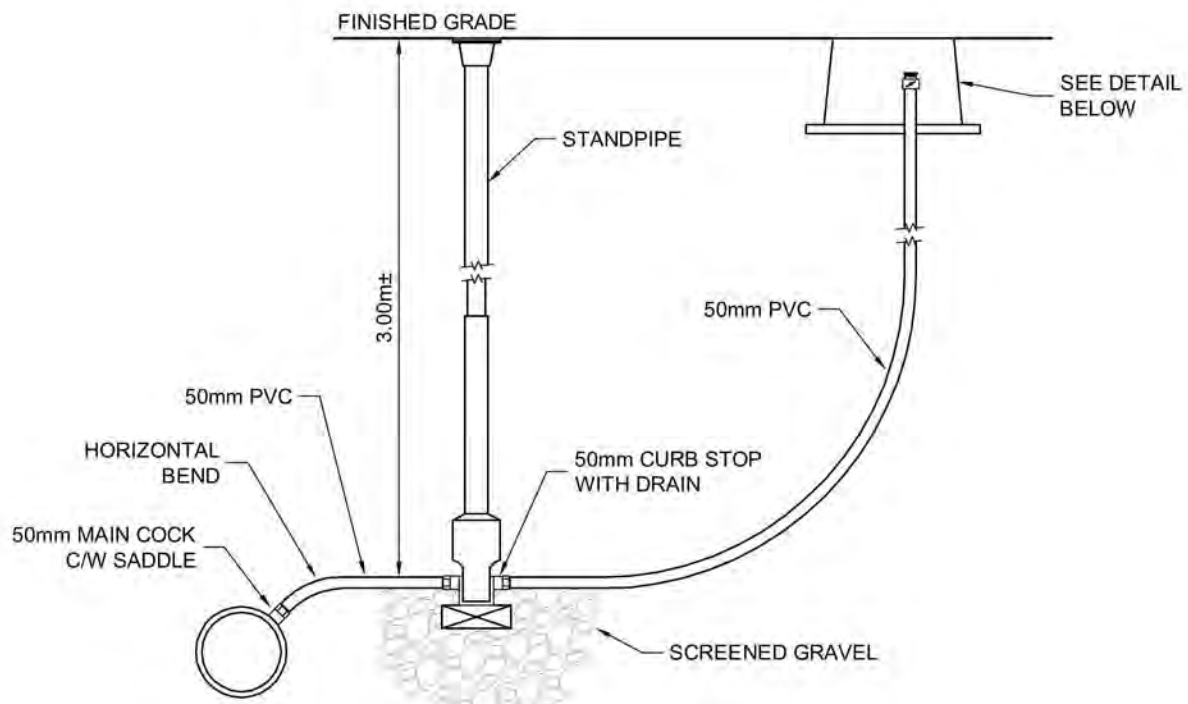
A.G.
DIRECTOR OF
PUBLIC WORKS

SCALE:
N.T.S.

DRAWING NO.

50.20.05

NO.	DATE	REVISION



THE TOWN OF SYLVAN LAKE

DRAWN BY:
D.K.

CONSTRUCTION SPECIFICATION DRAWINGS
Service Connections

APPROVED BY:

A.G.
DIRECTOR OF
PUBLIC WORKS

DATE:
JAN 2014

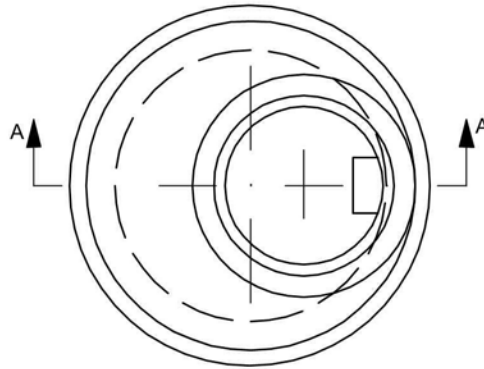
SCALE:
N.T.S.

AIR RELIEF VALVE
AND FLUSHING CHAMBER

DRAWING NO.

50.20.06

NO.	DATE	REVISION

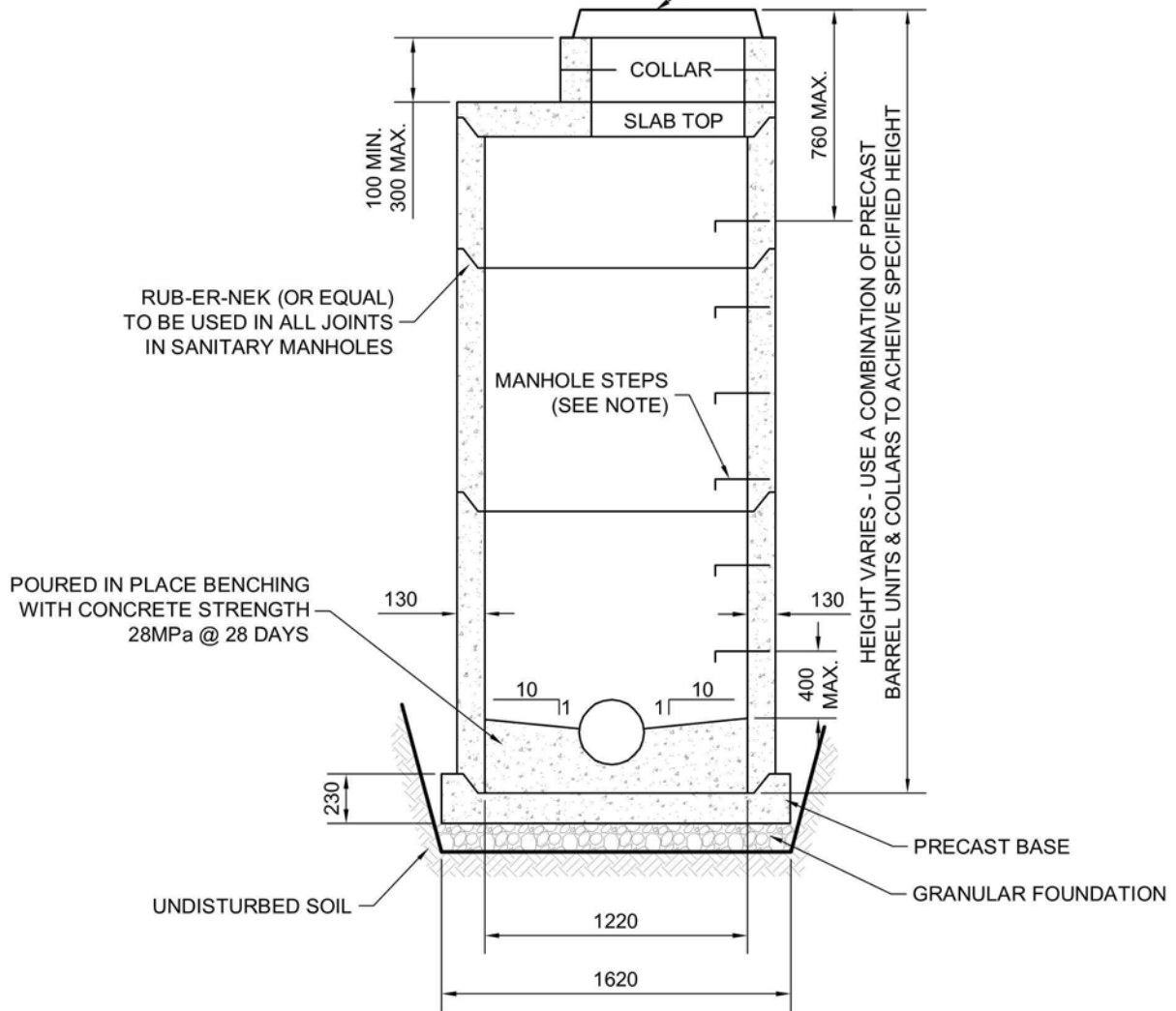


PLAN VIEW

NOTE :

- MANHOLE STEPS TO BE MSU 20mm O.D. ALUMINUM TUBING C/W 3mm LOW DENSITY POLYETHELENE COATING OR APPROVED EQUAL.
- STEPS TO BE @ 400 O.C.

FRAME & COVER
SANITARY - F39
STORM - F49



SECTION 'A - A'

THE TOWN OF SYLVAN LAKE

DRAWN BY:
D.K.

DATE:
JAN 2014

SCALE:
N.T.S.

CONSTRUCTION SPECIFICATION DRAWINGS
Manholes and Catch Basins

STANDARD 1200mm PRECAST
MANHOLE ASSEMBLY

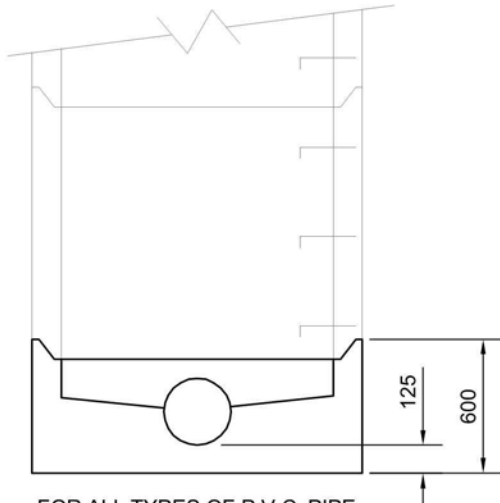
APPROVED BY:

A.G.
DIRECTOR OF
PUBLIC WORKS

DRAWING NO.

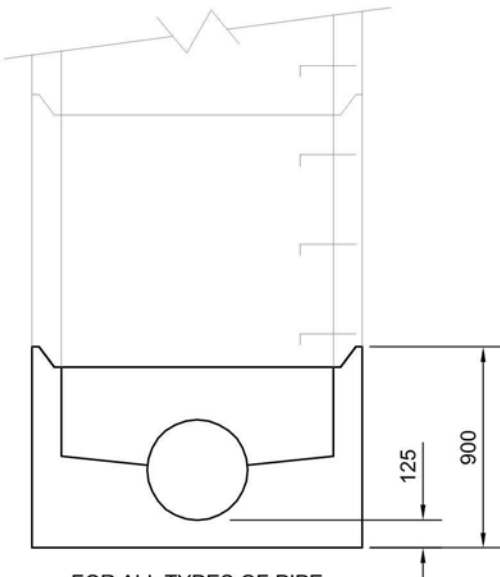
50.30.01

NO.	DATE	REVISION



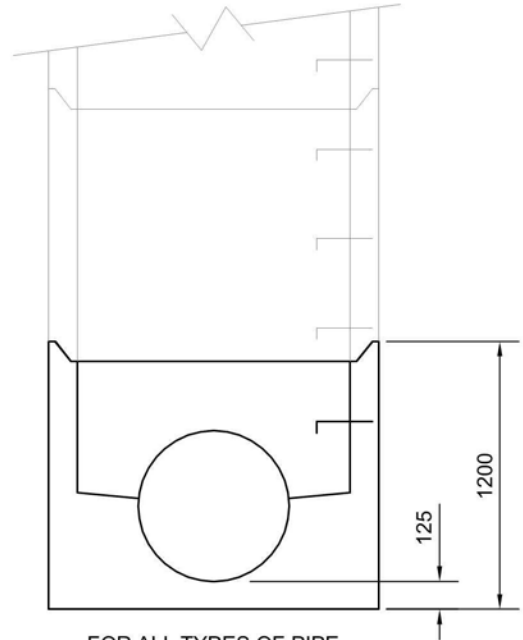
FOR ALL TYPES OF P.V.C. PIPE
SIZES 150mm to 300mm

600 PREBENCH



FOR ALL TYPES OF PIPE
SIZES 375mm to 450mm

900 PREBENCH

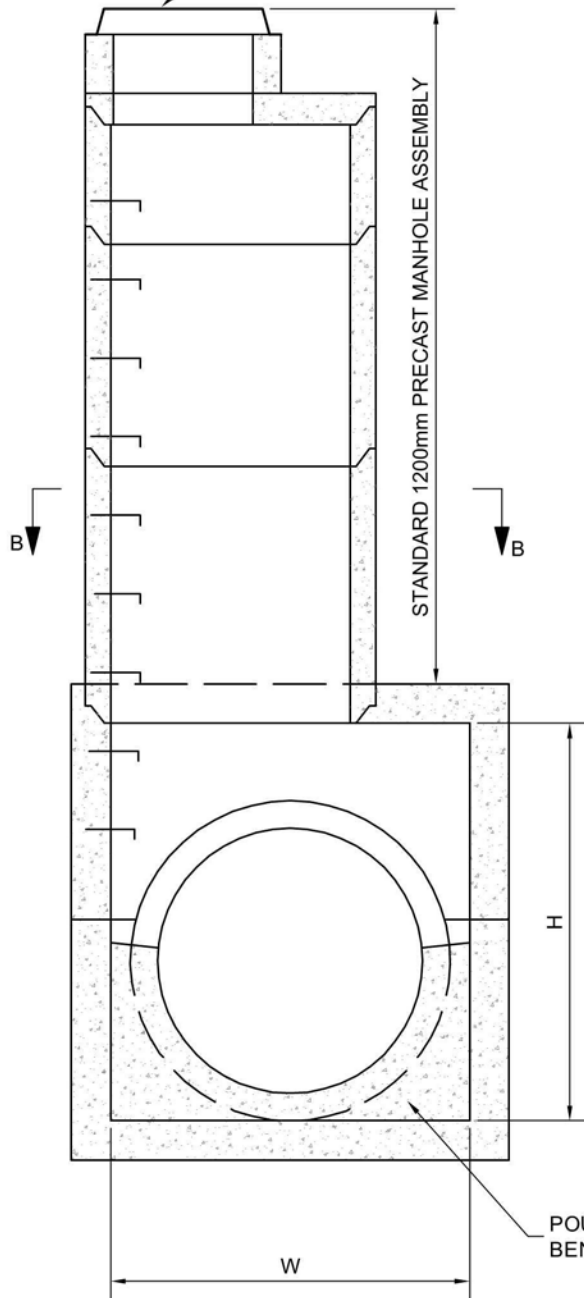


FOR ALL TYPES OF PIPE
SIZES 525mm to 675mm

1200 PREBENCH

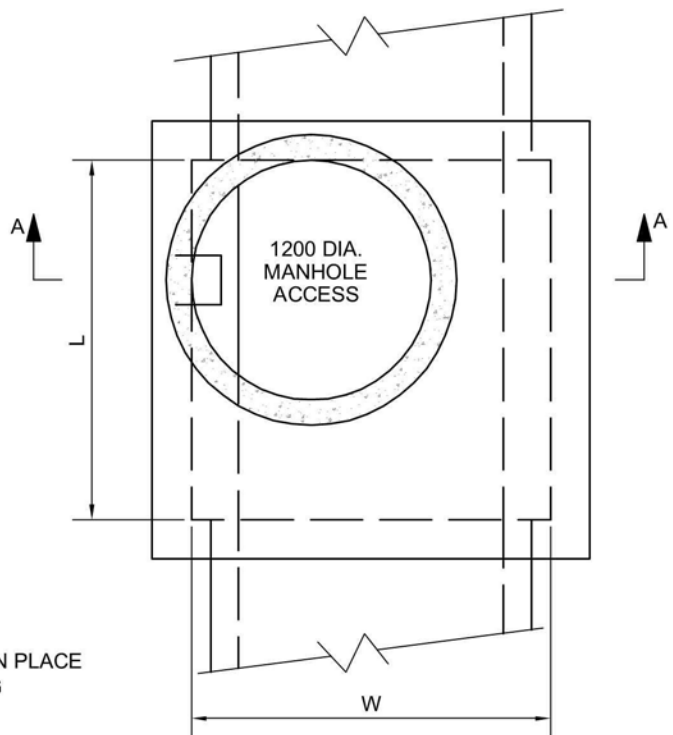
			THE TOWN OF SYLVAN LAKE		
			DRAWN BY: D.K.	CONSTRUCTION SPECIFICATION DRAWINGS Manholes and Catch Basins	APPROVED BY: <i>A.G.</i> DIRECTOR OF PUBLIC WORKS
			DATE: JAN 2014	PRECAST PREBENCHED BASES FOR 1200mm MANHOLE ASSEMBLY	DRAWING NO. 50.30.02
			SCALE: N.T.S.		
NO.	DATE	REVISION			

FRAME & COVER
SANITARY - F39
STORM - F49



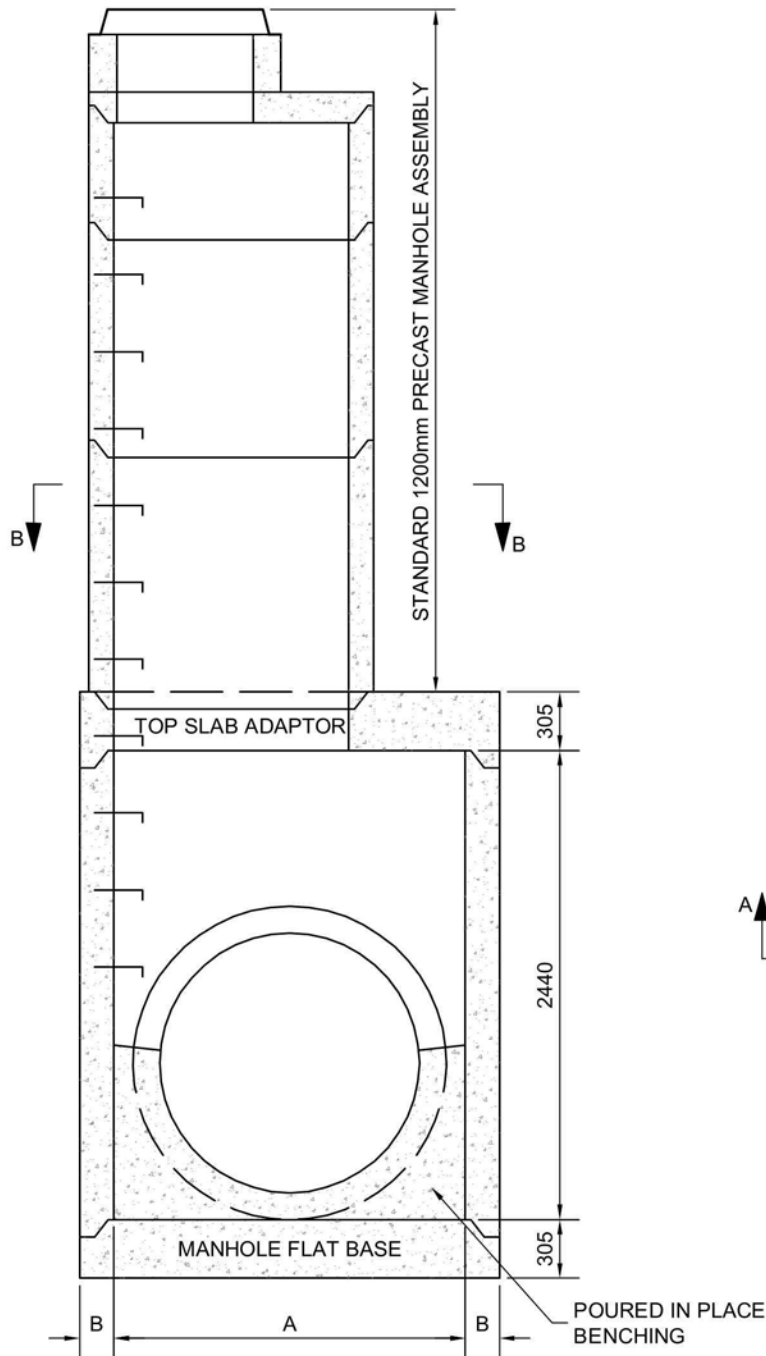
SECTION 'A - A'

VAULT NOMINAL INSIDE DIMENSIONS (mm)		
LENGTH L	WIDTH W	HEIGHT H
1200	1200	2020
1500	1500	2020
1800	1800	2020
2400	2400	2400
2800	2800	2800



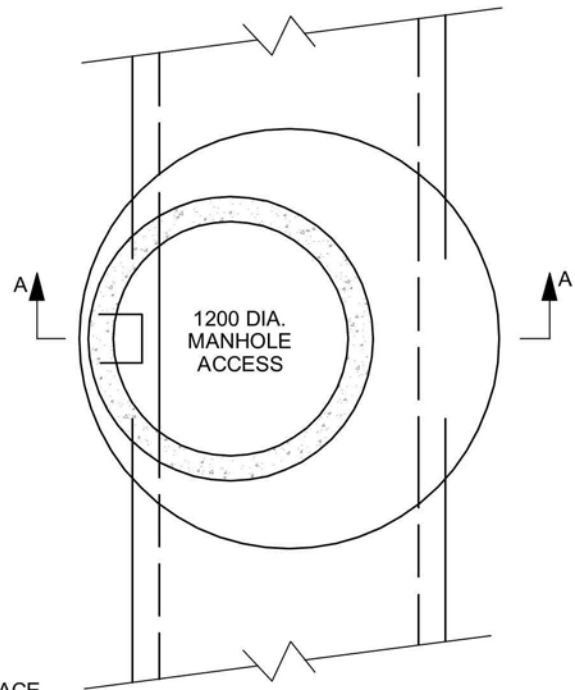
SECTION 'B - B'
PLAN VIEW

			THE TOWN OF SYLVAN LAKE		
			DRAWN BY: D.K.	CONSTRUCTION SPECIFICATION DRAWINGS Manholes and Catch Basins	APPROVED BY: A.G. DIRECTOR OF PUBLIC WORKS
			DATE: JAN 2014		
			SCALE: N.T.S.	1 - S PRECAST MANHOLE ASSEMBLY	DRAWING NO. 50.30.03
NO.	DATE	REVISION			




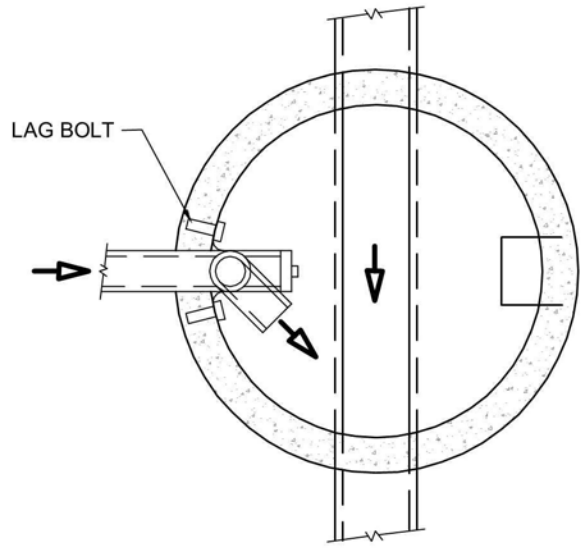
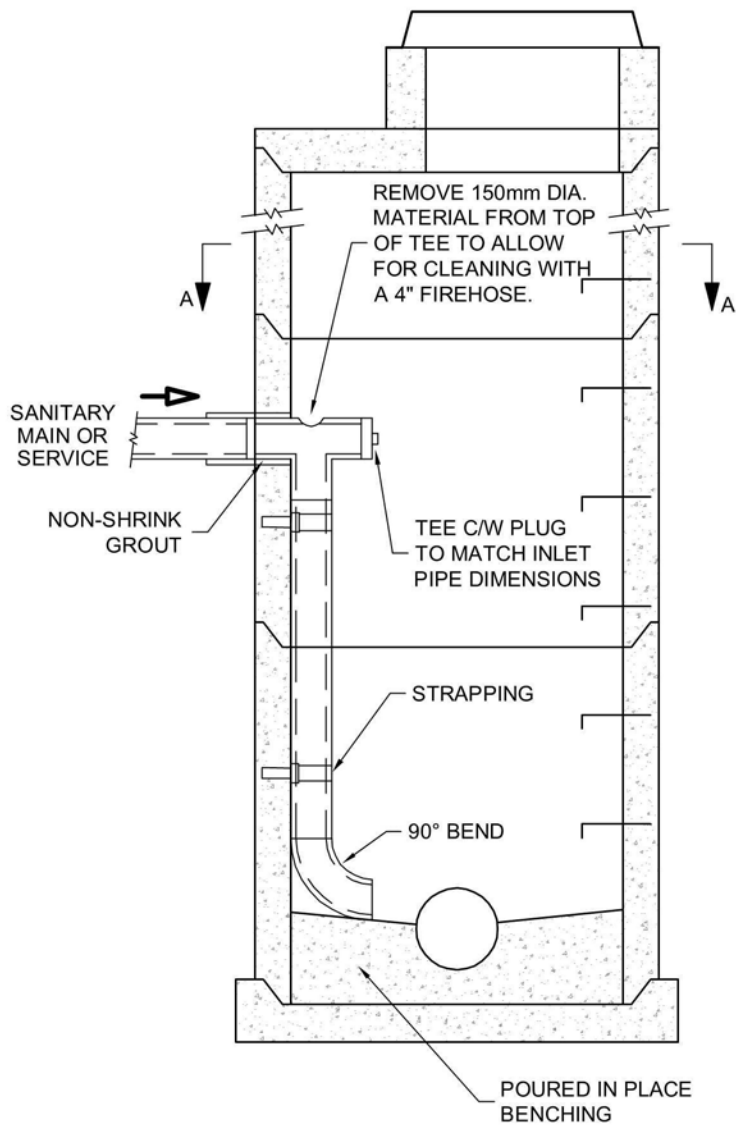
SECTION 'A - A'

DIMENSIONS (mm)	
A	B
INSIDE DIAMETER	WALL THICKNESS
1372	140
1524	155
1676	165
1829	178
2134	203
2438	229
3048	279



SECTION 'B - B'
PLAN VIEW

			THE TOWN OF SYLVAN LAKE		
			DRAWN BY: D.K.	CONSTRUCTION SPECIFICATION DRAWINGS Manholes and Catch Basins	APPROVED BY:  DIRECTOR OF PUBLIC WORKS
			DATE: JAN 2014		
			SCALE: N.T.S.	1500 - 3000mm LARGE DIAMETER MANHOLE ASSEMBLY	DRAWING NO. 50.30.04
NO.	DATE	REVISION			

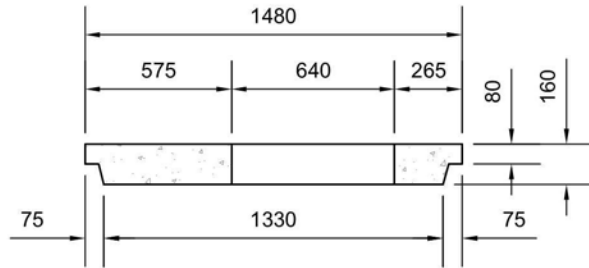
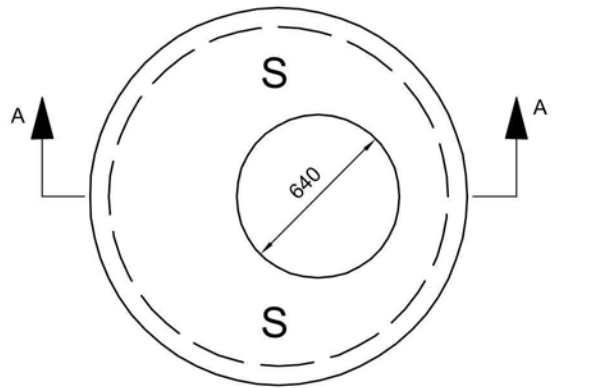


SECTION 'A - A'

NOTE :

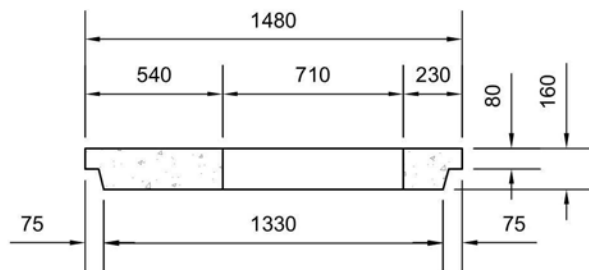
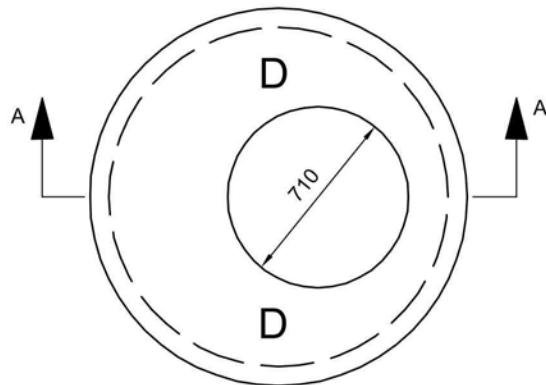
- LAG BOLTS AND STRAPPING ARE TO BE INSTALLED IMMEDIATELY BELOW THE TEE AND A CONTINUAL 1000mm VERTICAL SPACING TO THE BASE.
- DIAMETER SIZE AND TYPE OF VERTICAL PIPE TO MATCH INLET PIPE.

			THE TOWN OF SYLVAN LAKE			
			DRAWN BY: D.K.	CONSTRUCTION SPECIFICATION DRAWINGS Manholes and Catch Basins	APPROVED BY: <div>AG.</div> <div>DIRECTOR OF PUBLIC WORKS</div>	
			DATE: JAN 2014			
			SCALE: N.T.S.		INTERIOR DROP SANITARY MANHOLE	DRAWING NO. 50.30.05
NO.	DATE	REVISION				



SANITARY MANHOLE

NOTE :
IMPRINT "S" ON SANITARY SLAB
TOP AND "D" ON STORM SLAB TOP.



STORM MANHOLE

THE TOWN OF SYLVAN LAKE

DRAWN BY:
D.K.

DATE:
JAN 2014

SCALE:
N.T.S.

CONSTRUCTION SPECIFICATION DRAWINGS
Manholes and Catch Basins

**PRECAST SLAB TOPS
FOR 1200mm MANHOLES**

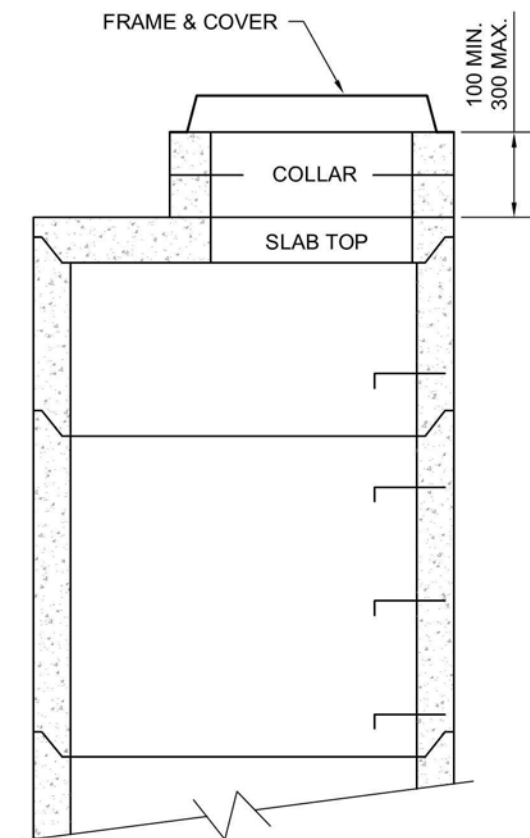
APPROVED BY:

A.G.
DIRECTOR OF
PUBLIC WORKS

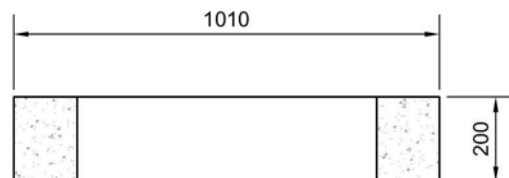
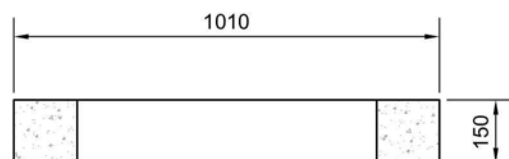
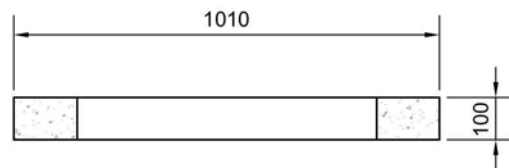
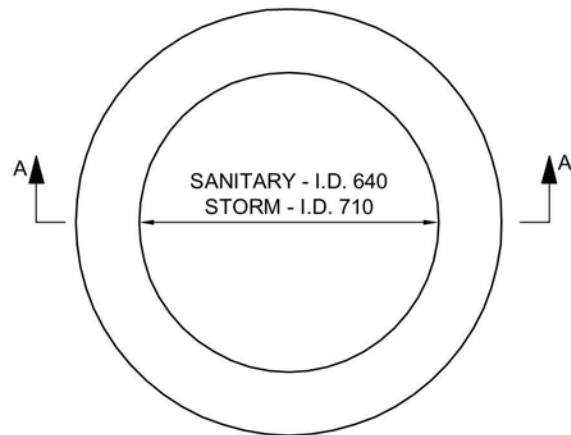
DRAWING NO.

50.30.06

NO.	DATE	REVISION

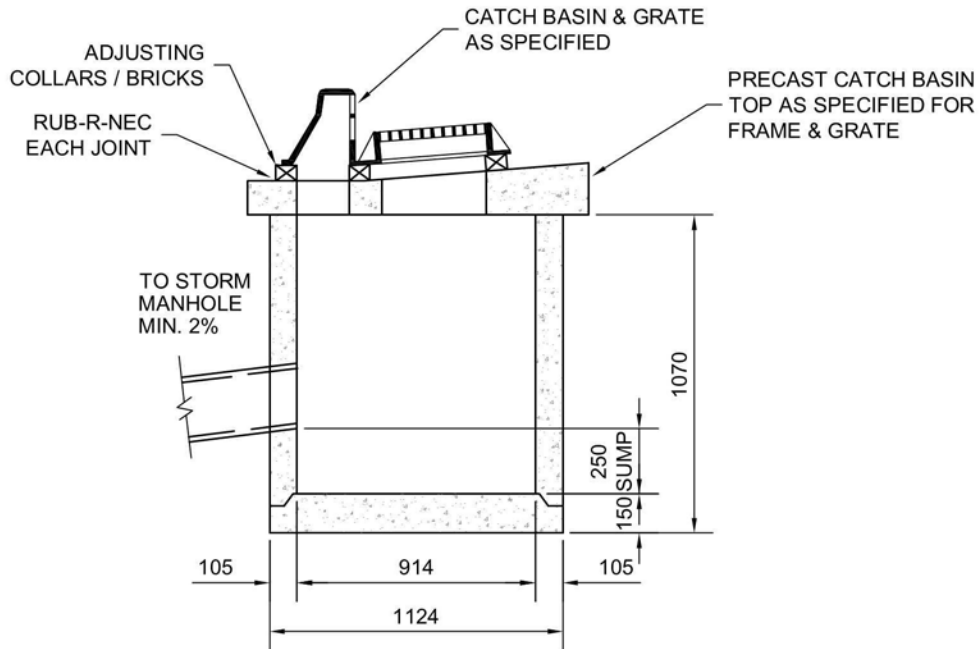


NOTE;
IMPRINT AN "S" ON SANITARY COLLARS
AND A "D" ON STORM COLLARS

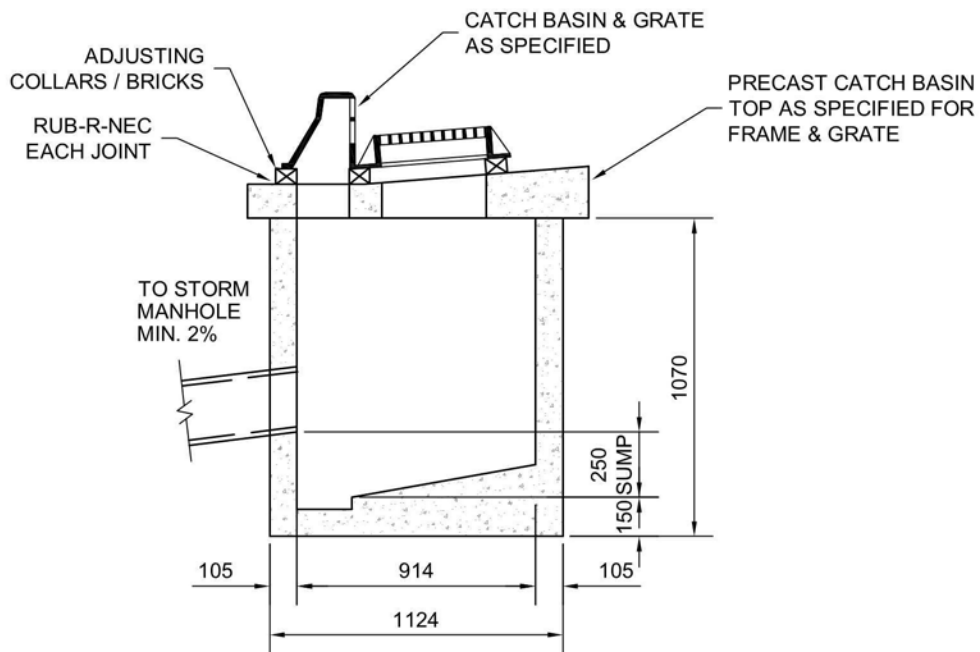


SECTIONS 'A - A'

			THE TOWN OF SYLVAN LAKE		
			DRAWN BY: D.K.	CONSTRUCTION SPECIFICATION DRAWINGS Manholes and Catch Basins	APPROVED BY: A.G. DIRECTOR OF PUBLIC WORKS
			DATE: JAN 2014		
			SCALE: N.T.S.	SANITARY & STORM MANHOLE ADJUSTING COLLAR	DRAWING NO. 50.30.07
NO.	DATE	REVISION			



SEPARATE BASE CATCHBASIN



MONOLITHIC BASE CATCHBASIN

THE TOWN OF SYLVAN LAKE

DRAWN BY:
D.K.

DATE:
JAN 2014

SCALE:
N.T.S.

CONSTRUCTION SPECIFICATION DRAWINGS
Manholes and Catch Basins

PRECAST CATCH BASIN
ASSEMBLY

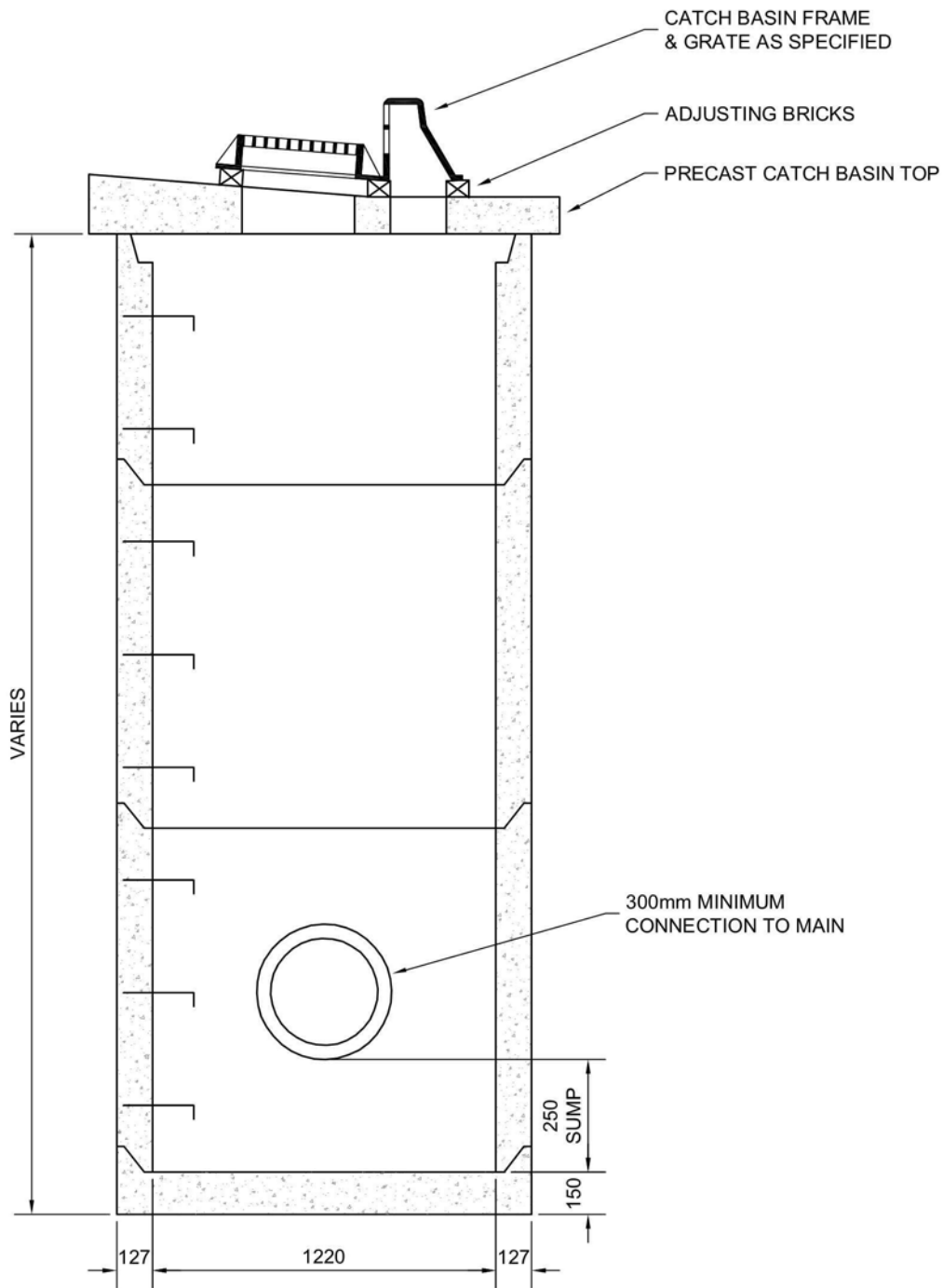
APPROVED BY:

A.G.
DIRECTOR OF
PUBLIC WORKS

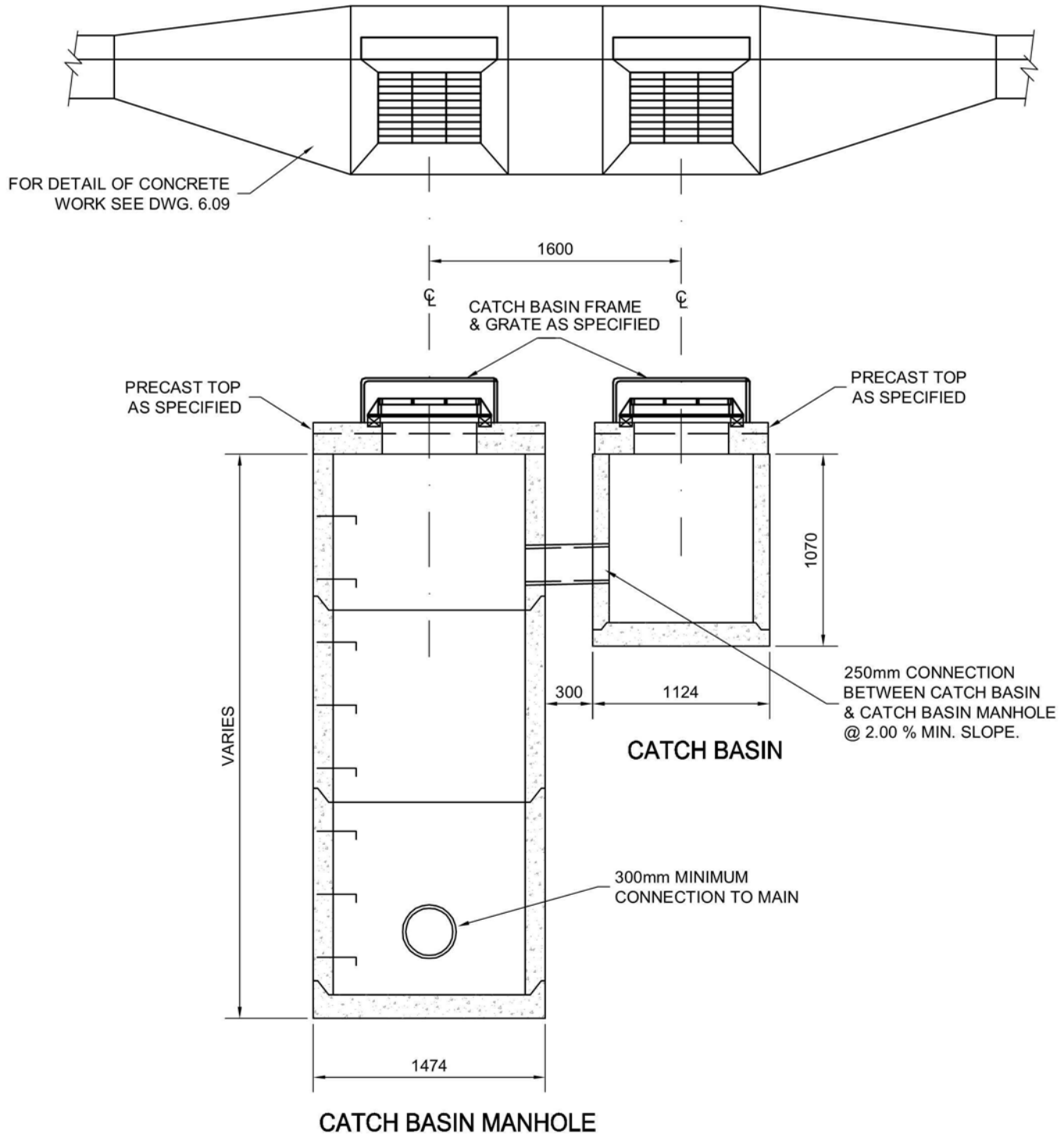
DRAWING NO.


50.30.09

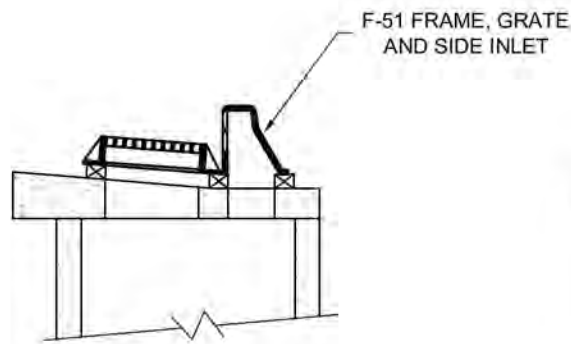
NO.	DATE	REVISION



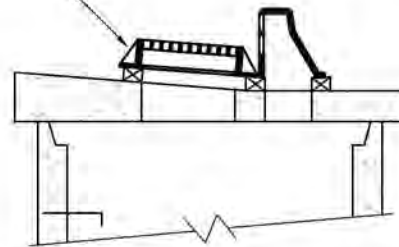
			THE TOWN OF SYLVAN LAKE		
			DRAWN BY: D.K.	CONSTRUCTION SPECIFICATION DRAWINGS Manholes and Catch Basins	APPROVED BY: A.G. DIRECTOR OF PUBLIC WORKS
			DATE: JAN 2014	1200mm CATCH BASIN MANHOLE ASSEMBLY	DRAWING NO. 50.30.10
			SCALE: N.T.S.		
NO.	DATE	REVISION			



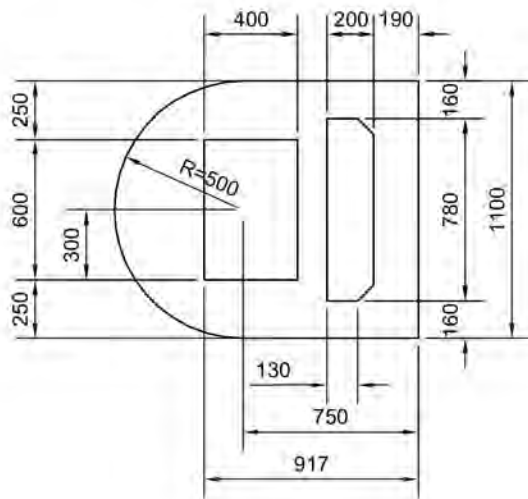
			THE TOWN OF SYLVAN LAKE			
			DRAWN BY:	CONSTRUCTION SPECIFICATION DRAWINGS	APPROVED BY:	
			D.K.	Manholes and Catch Basins	 DIRECTOR OF PUBLIC WORKS	
			DATE:	TWIN CATCH BASIN/CATCH BASIN MANHOLE ASSEMBLY		DRAWING NO. 50.30.11
			JAN 2014			
			SCALE:			
			N.T.S.			
NO.	DATE	REVISION				



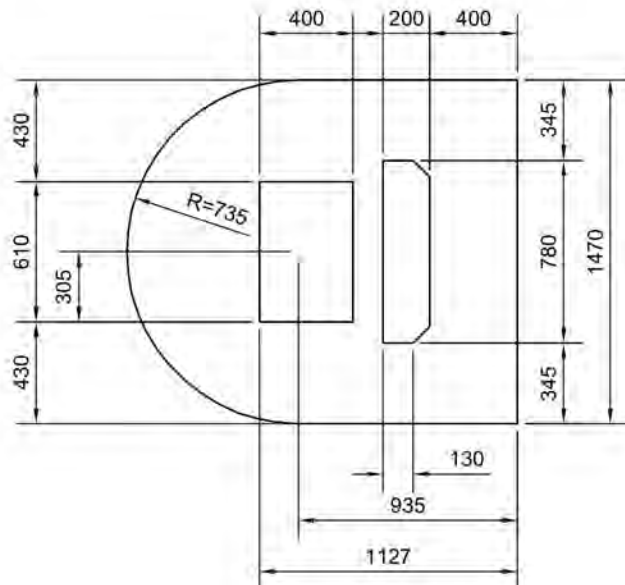
K1 CATCH BASIN



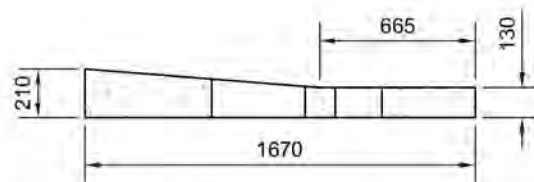
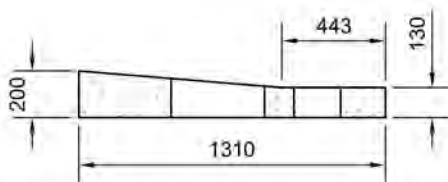
K1 CATCH BASIN MANHOLE



PRECAST K-1 TOP FOR F-51 CB
FRAME, GRATE, AND SIDE INLET



PRECAST K-1 TOP FOR F-51 CBMH
FRAME, GRATE, AND SIDE INLET



THE TOWN OF SYLVAN LAKE

DRAWN BY:
D.K.

DATE:
JAN 2014

SCALE:
N.T.S.

CONSTRUCTION SPECIFICATION DRAWINGS
Manholes and Catch Basins

TYPE K-1 CATCH BASIN AND
CATCH BASIN MANHOLE
TOP SECTION

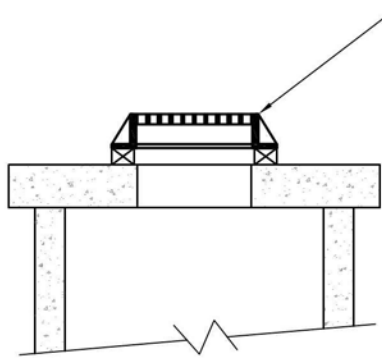
APPROVED BY:

A.G.

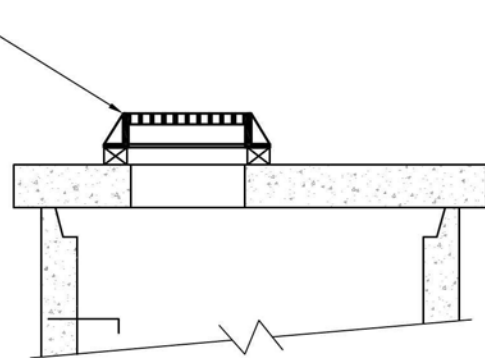
DIRECTOR OF
PUBLIC WORKS

DRAWING NO.

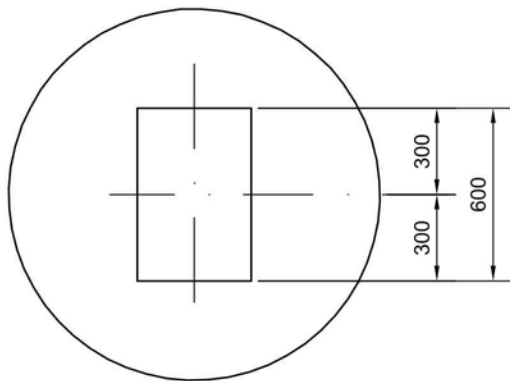
50.30.12



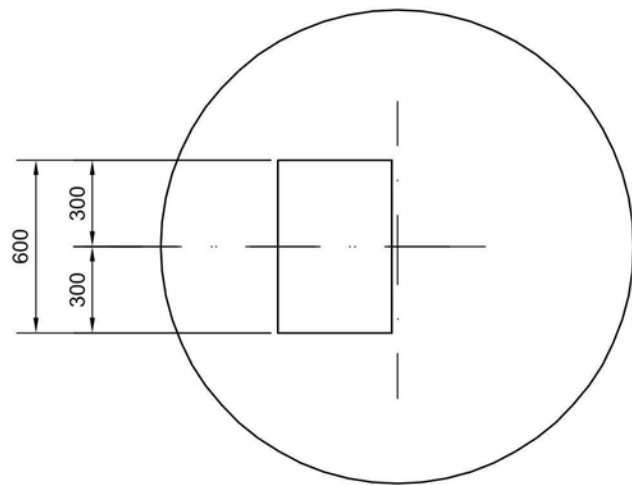
K-3 CATCH BASIN



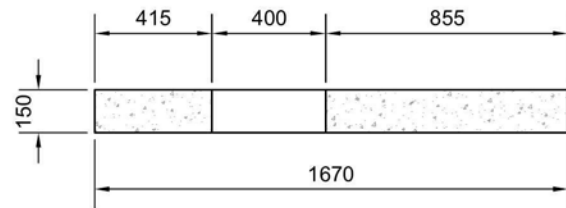
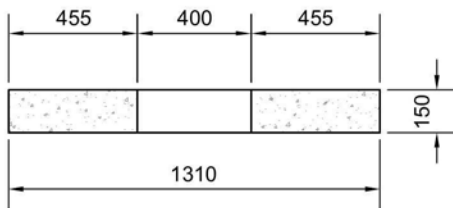
K-3 CATCH BASIN MANHOLE



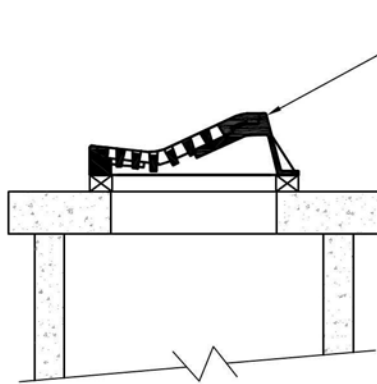
PRECAST K-3 CATCH BASIN TOP
FOR F-51 CB FRAME AND GRATE



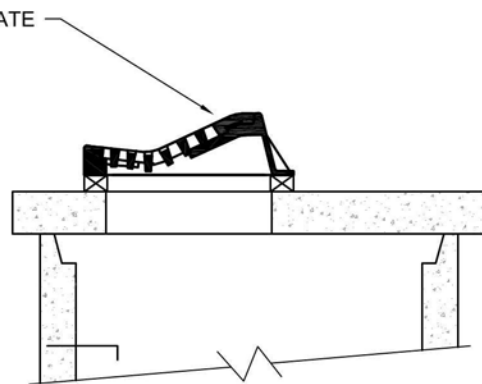
PRECAST K-3 CATCH BASIN MANHOLE
TOP FOR F-51 CB FRAME AND GRATE



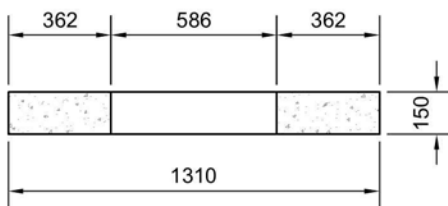
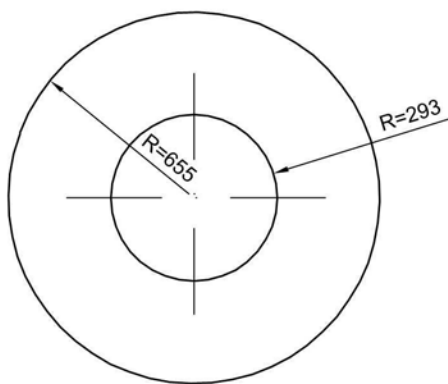
			THE TOWN OF SYLVAN LAKE		
			DRAWN BY: D.K.	CONSTRUCTION SPECIFICATION DRAWINGS Manholes and Catch Basins	APPROVED BY: A.G. DIRECTOR OF PUBLIC WORKS
			DATE: JAN 2014		
			SCALE: N.T.S.	TYPE K-3 CATCH BASIN AND CATCH BASIN MANHOLE TOP SECTION	DRAWING NO. 50.30.13
NO.	DATE	REVISION			



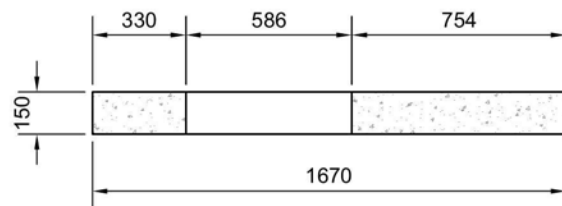
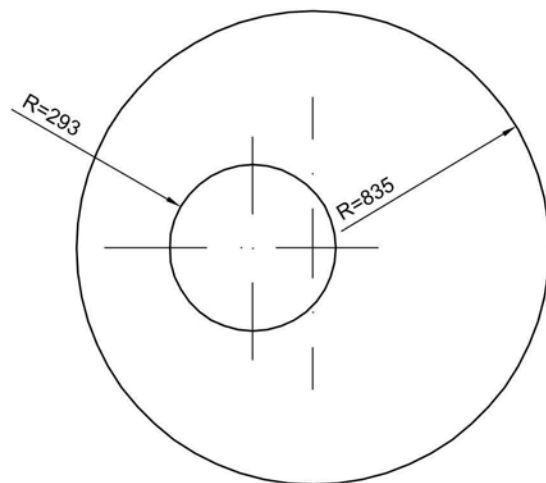
K-4 CATCH BASIN




K-4 CATCH BASIN MANHOLE

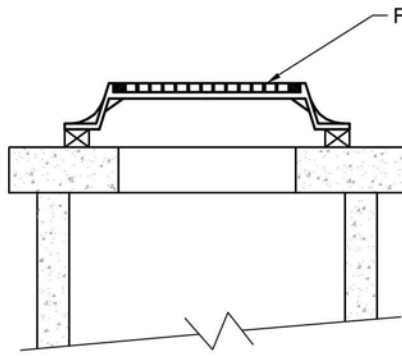


PRECAST M CATCH BASIN TOP
FOR F-33 CB FRAME AND GRATE

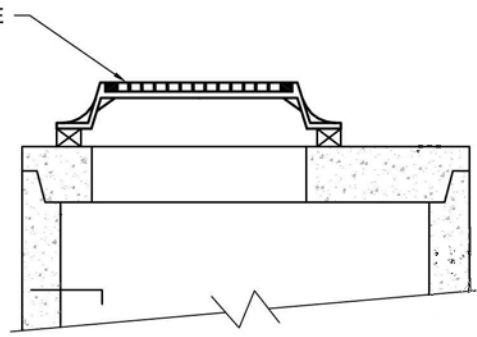


PRECAST M CATCH BASIN MANHOLE TOP
FOR F-33 CBMH FRAME AND GRATE

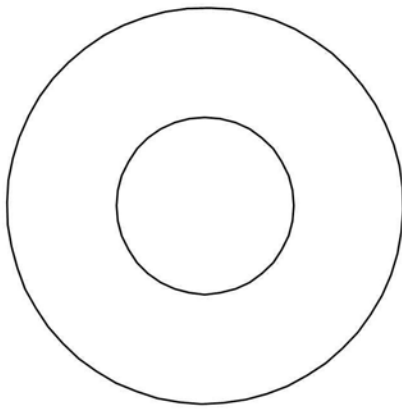
			THE TOWN OF SYLVAN LAKE		
			DRAWN BY: D.K.	CONSTRUCTION SPECIFICATION DRAWINGS Manholes and Catch Basins	APPROVED BY:  DIRECTOR OF PUBLIC WORKS
			DATE: JAN 2014		
			SCALE: N.T.S.	TYPE K-4 CATCH BASIN AND CATCH BASIN MANHOLE TOP SECTION	DRAWING NO. 50.30.14
NO.	DATE	REVISION			



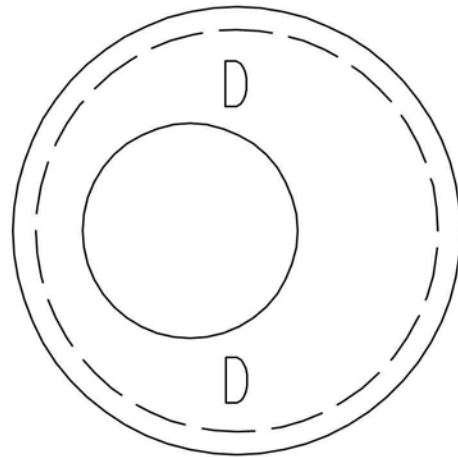
K-6 CATCH BASIN



K-6 CATCH BASIN MANHOLE



PRECAST M CATCH BASIN TOP
FOR F-49 FRAME AND GRATE
(AS PER DWG.3.15)



PRECAST STORM MANHOLE TOP
(AS PER DWG. 3.06)



THE TOWN OF SYLVAN LAKE

DRAWN BY:
D.K.

DATE:
JAN 2014

SCALE:
N.T.S.

CONSTRUCTION SPECIFICATION DRAWINGS
Manholes and Catch Basins

TYPE K-6 CATCH BASIN AND
CATCH BASIN MANHOLE
TOP SECTION

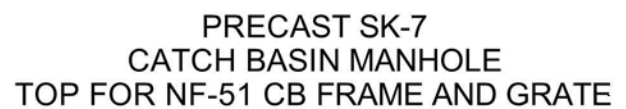
APPROVED BY:


A.G.
DIRECTOR OF
PUBLIC WORKS

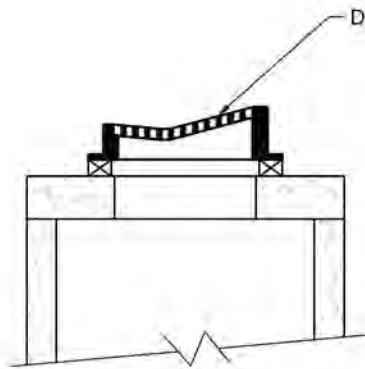
DRAWING NO.

50.30.15

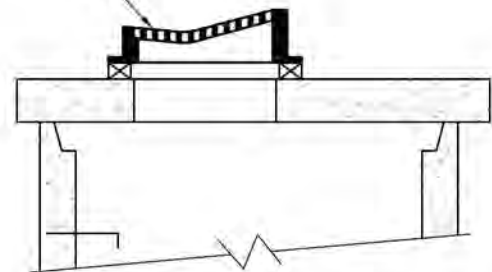
NO.	DATE	REVISION



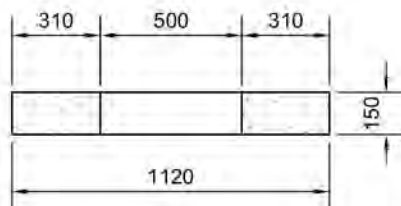
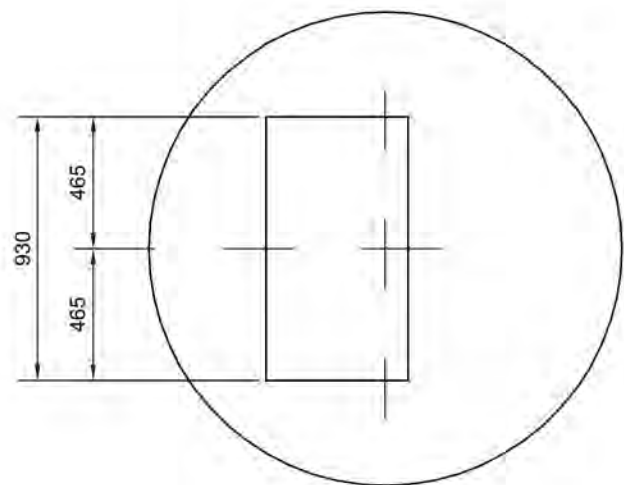
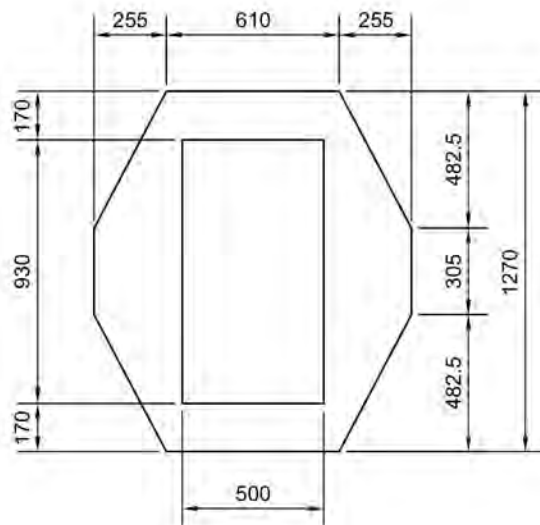
			THE TOWN OF SYLVAN LAKE		
			DRAWN BY: D.K.	CONSTRUCTION SPECIFICATION DRAWINGS Manholes and Catch Basins	APPROVED BY:  DIRECTOR OF PUBLIC WORKS
			DATE: JAN 2014	TYPE K-7 CATCH BASIN AND CATCH BASIN MANHOLE TOP SECTION	DRAWING NO. 50.30.16
			SCALE: N.T.S.		
NO.	DATE	REVISION			



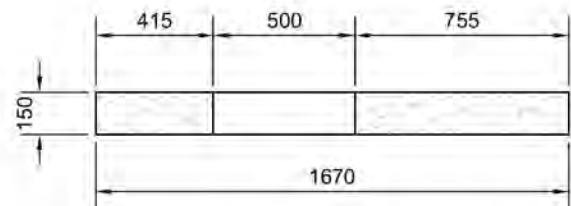
DK-7 CATCH BASIN



DK-7 CATCH BASIN MANHOLE

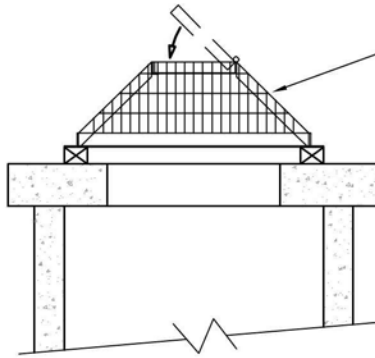


PRECAST DK-7 CATCH BASIN TOP
FOR DK-7 DOUBLE FRAME AND GRATE

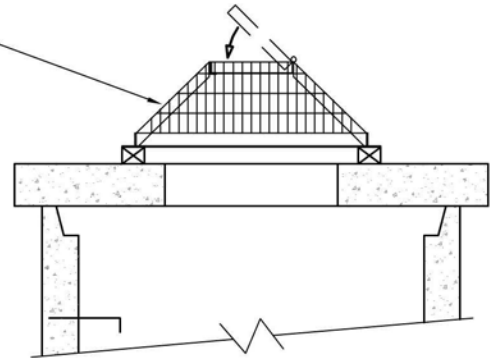


PRECAST DK-7 CATCH BASIN MANHOLE
TOP FOR DK-7 DOUBLE FRAME AND GRATE

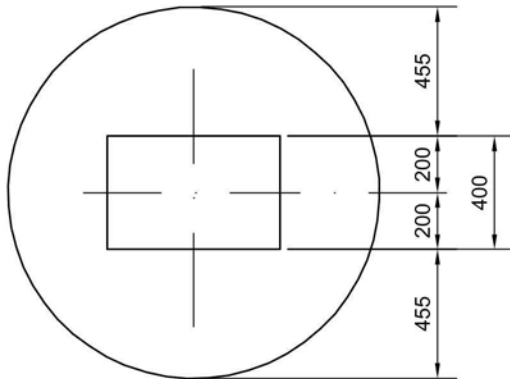
THE TOWN OF SYLVAN LAKE			
		DRAWN BY: D.K.	CONSTRUCTION SPECIFICATION DRAWINGS Manholes and Catch Basins
		DATE: JAN 2014	TYPE DK-7 CATCH BASIN AND CATCH BASIN MANHOLE TOP SECTION
		SCALE: N.T.S.	
NO.	DATE	REVISION	APPROVED BY: A.G. DIRECTOR OF PUBLIC WORKS DRAWING NO. 50.30.17



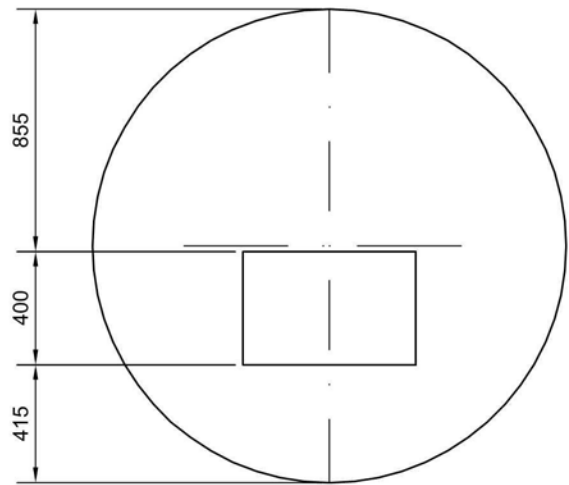
TRASH GRATE CATCH BASIN



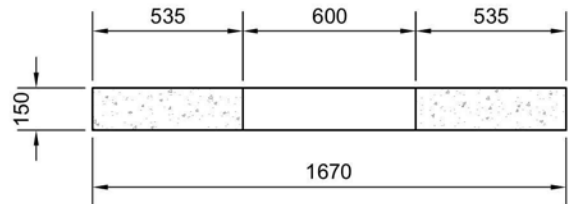
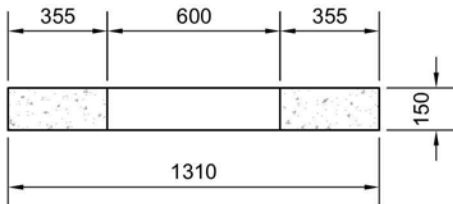
TRASH GRATE CATCH BASIN MANHOLE



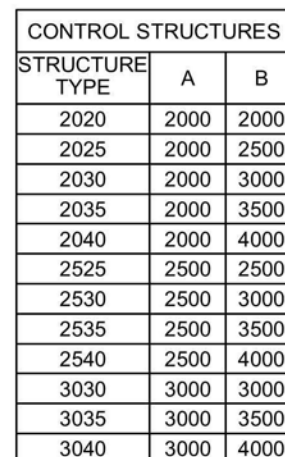
PRECAST K-3 CATCH BASIN TOP
FOR TRASH GRATE




PRECAST K-3 CATCH BASIN TOP
FOR TRASH GRATE

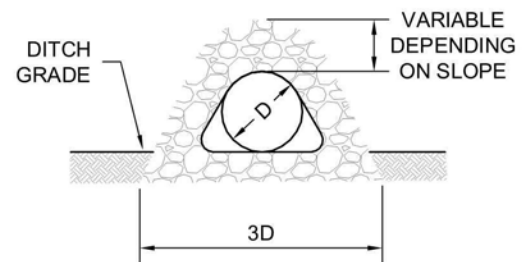


			THE TOWN OF SYLVAN LAKE		
			DRAWN BY: D.K.	CONSTRUCTION SPECIFICATION DRAWINGS Manholes and Catch Basins	APPROVED BY: A.G. DIRECTOR OF PUBLIC WORKS
			DATE: JAN 2014		
			SCALE: N.T.S.	TRASH GRATE CATCH BASIN CATCH BASIN MANHOLE TOP SECTION	DRAWING NO. 50.30.18
NO.	DATE	REVISION			

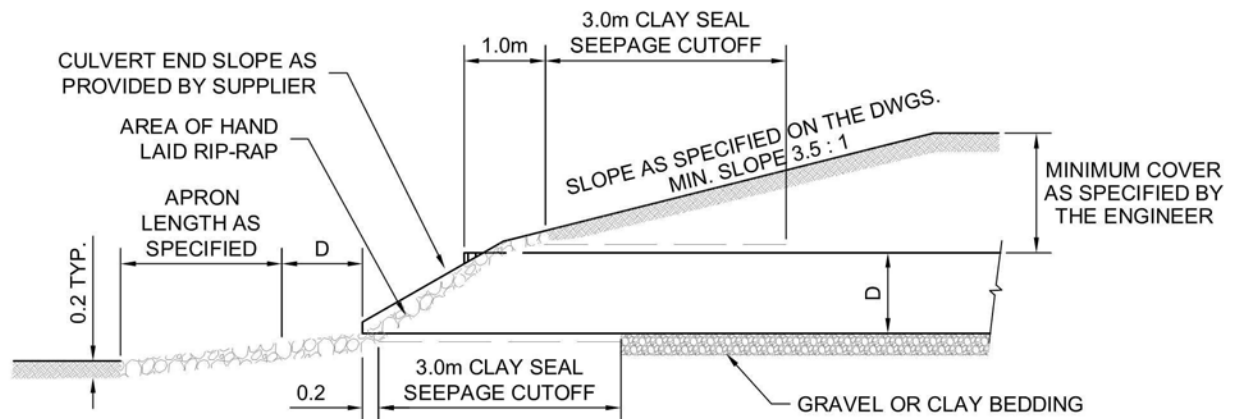


SECTION "B - B"

			THE TOWN OF SYLVAN LAKE		
			DRAWN BY: D.K.	CONSTRUCTION SPECIFICATION DRAWINGS Manholes and Catch Basins	APPROVED BY:  DIRECTOR OF PUBLIC WORKS
			DATE: JAN 2014	TYPICAL OUTLET CONTROL STRUCTURE	DRAWING NO. 50.30.19
			SCALE: N.T.S.		
NO.	DATE	REVISION			



PLAN VIEW



SECTION

NOTE :

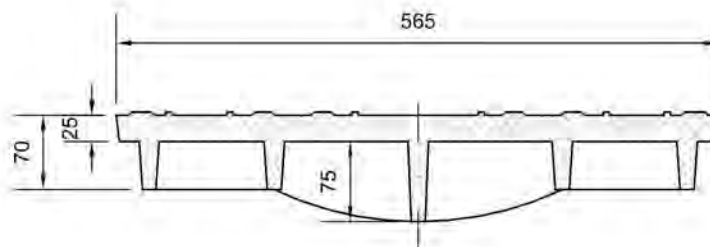
- PLACE ROCKS AND BOULDERS AS DETAILED IN SECTION 02371.
- A CLAY SEAL IS TO BE PLACED AT BOTH ENDS OF THE CULVERT FOR A LENGTH OF 3.0M TO CUT OFF SEEPAGE. THE CLAY SEAL SHALL EXTEND FROM THE BOTTOM OF THE EXCAVATION TO 300mm ABOVE THE CROWN OF THE PIPE, & FOR THE FULL WIDTH OF THE OF THE EXCAVATION.
- WHERE APRONS ARE REQUIRED DUE TO HIGH VELOCITY FLOW OR EROSION PRONE SOIL, TYPICALLY THE MINIMUM INLET APRON IS 1.5 X DIAMETER LONG WHILE THE MINIMUM OUTLET APRON (WHERE WATER VELOCITY IS HIGHER) IS 2.0M LONG.

ESTIMATED RIP-RAP SURFACE AREAS (BASED ON A 4:1 SIDESLOPE)			
PIPE DIAMETER (mm)	AREA OF ONE END EXCLUDING APRON (sq. m)	AREA OF ONE END INCLUDING INLET APRON (sq. m)	AREA OF ONE END INCLUDING OUTLET APRON (sq. m)
400	1	1.5	2
500	2	3	4
600	3	5	6
700	4	6	7
800	5	8	9
900	6	10	11
1000	7	12	13
1100	9	14	16
1200	10	16	19
1400	13	22	25

			THE TOWN OF SYLVAN LAKE		
			DRAWN BY: D.K.	CONSTRUCTION SPECIFICATION DRAWINGS Manholes and Catch Basins	APPROVED BY: A.G. DIRECTOR OF PUBLIC WORKS
			DATE: JAN 2014	RIP-RAP CULVERT END TREATMENT	DRAWING NO. 50.30.20
			SCALE: N.T.S.		
NO.	DATE	REVISION			

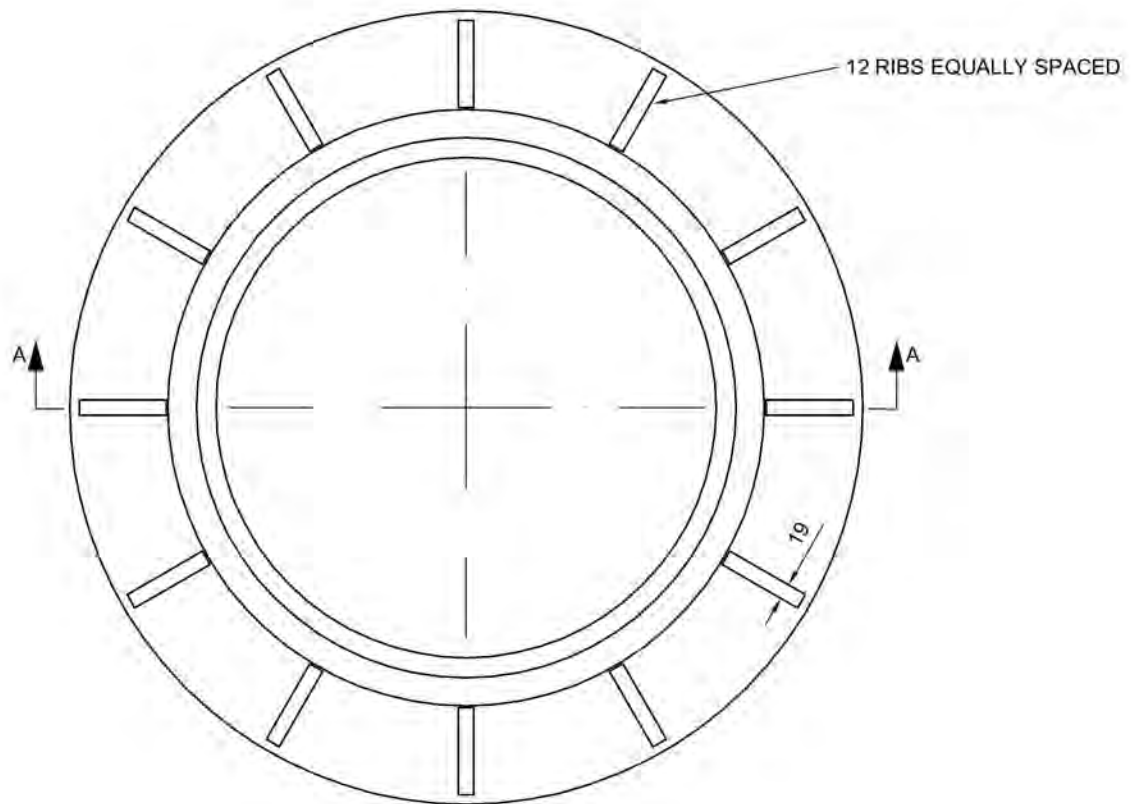


PLAN

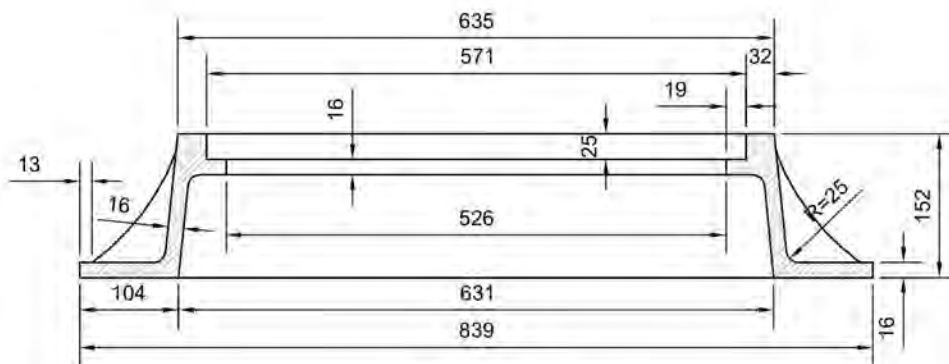


SECTION 'A - A'

			THE TOWN OF SYLVAN LAKE		
			DRAWN BY: D.K.	CONSTRUCTION SPECIFICATION DRAWINGS Manholes and Catch Basins	APPROVED BY: A.G. DIRECTOR OF PUBLIC WORKS
			DATE: JAN 2014		
			SCALE: N.T.S.	F-39 STANDARD SANITARY SEWER MANHOLE COVER	DRAWING NO. 50.30.21
NO.	DATE	REVISION			



PLAN



SECTION 'A - A'

MATERIAL SPECIFICATION :

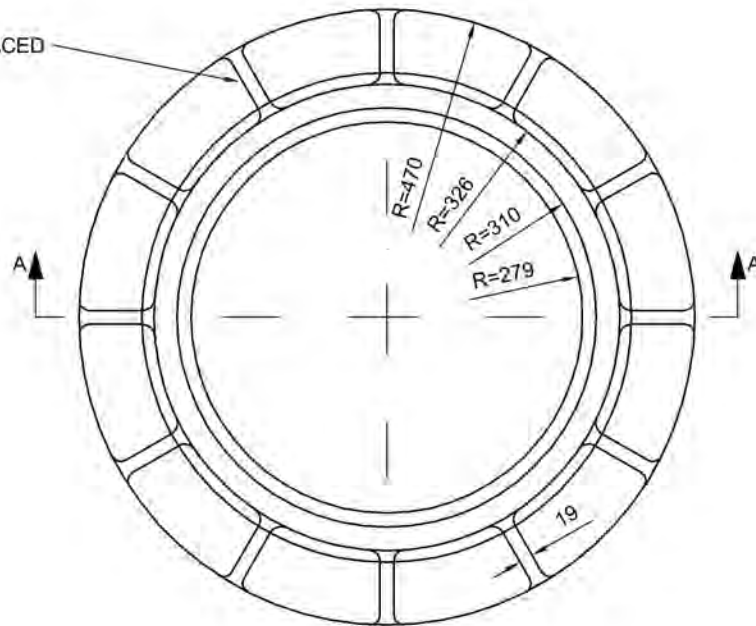
- GREY CAST IRON TP CONFORM TO CLASS 20 A.S.T.M. A48
- MASS = 80 KG
- DIMENSIONS IN MILLIMETERS

NOTE:

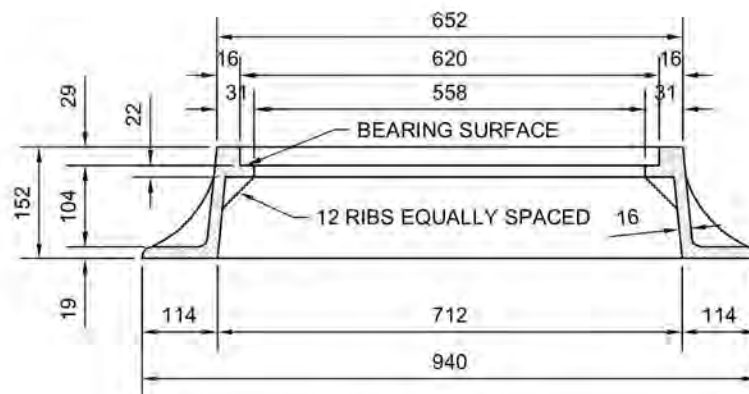
- MANHOLE COVER TO BE TO TOWN OF SYLVAN LAKE DESIGN

			THE TOWN OF SYLVAN LAKE		
			DRAWN BY: D.K.	CONSTRUCTION SPECIFICATION DRAWINGS Manholes and Catch Basins	APPROVED BY: A.G. DIRECTOR OF PUBLIC WORKS
			DATE JAN 2014	F-39 STANDARD SANITARY SEWER MANHOLE FRAME	DRAWING NO. 50.30.22
			SCALE: N.T.S.		
NO.	DATE	REVISION			

12 RIBS EQUALLY SPACED



PLAN



SECTION 'A - A'

MATERIAL SPECIFICATION :

- GREY CAST IRON TP CONFORM TO CLASS 20 A.S.T.M. A48
- BEARING SURFACE SHALL BE GROUND OR MACHINED TO PREVENT ROCKING
- HOT DIPPED IN ASPHALT
- MASS = ± 80 KG
- DIMENSIONS IN MILLIMETERS

THE TOWN OF SYLVAN LAKE

DRAWN BY:
D.K.

DATE:
JAN 2014

SCALE:
N.T.S.

CONSTRUCTION SPECIFICATION DRAWINGS
Manholes and Catch Basins

**F-49 STANDARD
STORM SEWER
MANHOLE FRAME**

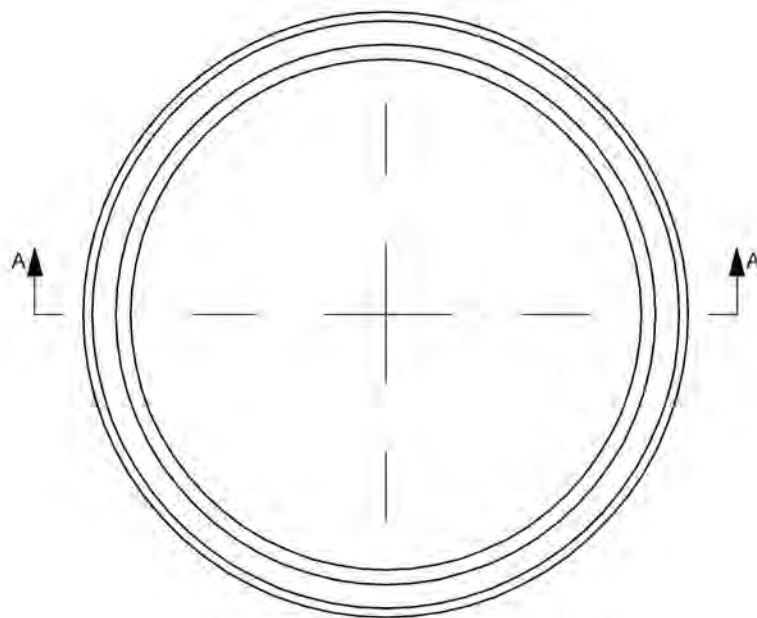
APPROVED BY:

AG

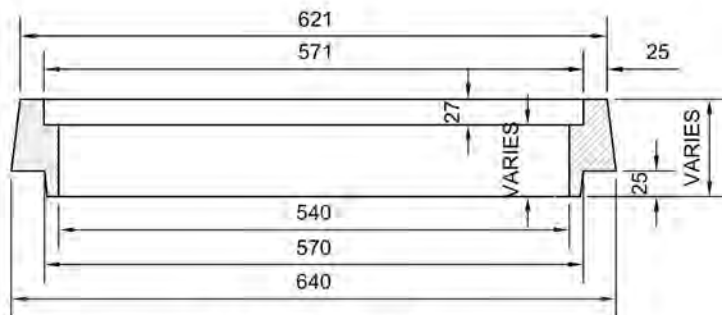
DIRECTOR OF
PUBLIC WORKS

DRAWING NO.

50.30.23

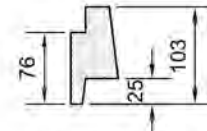


PLAN

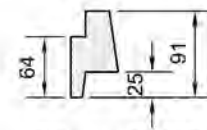


SECTION 'A - A'

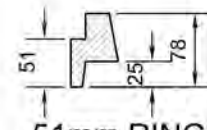
RISER RINGS DETAILS



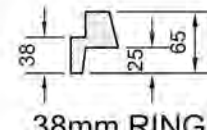
76mm RING



64mm RING



51mm RING



38mm RING

MATERIAL SPECIFICATION :

- GREY CAST IRON CLASS 20 A.S.T.M. A48
- MASS : 22 ; 29 ; 36 ; 43 KG

THE TOWN OF SYLVAN LAKE

DRAWN BY:
D.K.

DATE:
JAN 2014

SCALE:
N.T.S.

CONSTRUCTION SPECIFICATION DRAWINGS
Manholes and Catch Basins

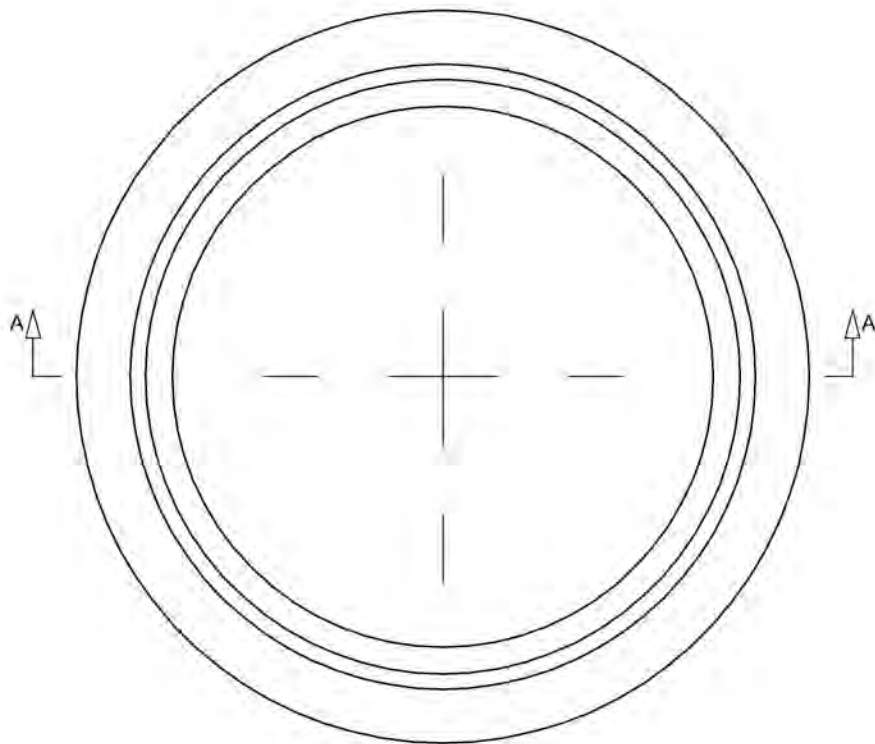
F-39 SANITARY SEWER
MANHOLE RISER FRAME RINGS

APPROVED BY:

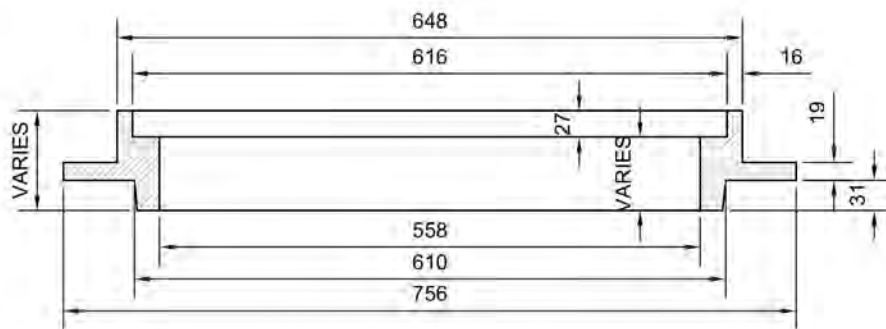
A.G.
DIRECTOR OF
PUBLIC WORKS

DRAWING NO.

50.30.24

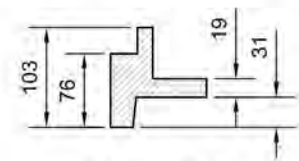


PLAN

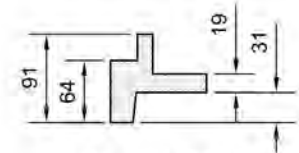


SECTION 'A - A'

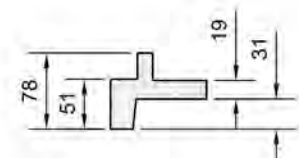
RISER RINGS DETAILS



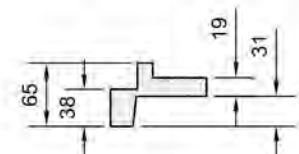
76mm RING



64mm RING



51mm RING

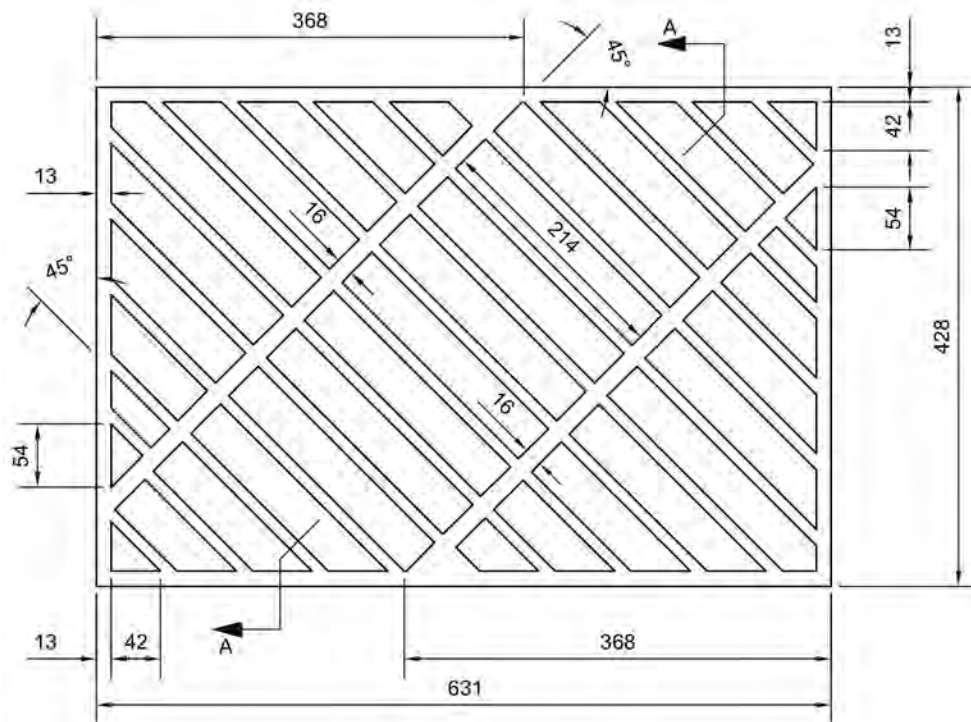


38mm RING

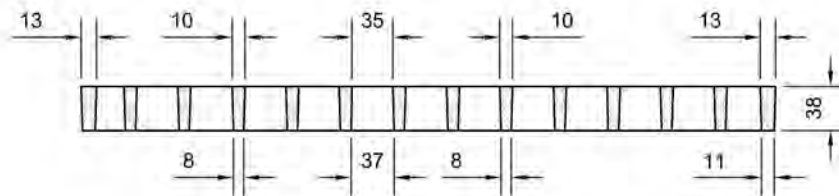
MATERIAL SPECIFICATION :

- GREY CAST IRON CLASS 20 A.S.T.M. A48
- MASS : 23 ; 31 ; 39 ; 46 KG

			THE TOWN OF SYLVAN LAKE		
			DRAWN BY: D.K.	CONSTRUCTION SPECIFICATION DRAWINGS Manholes and Catch Basins	APPROVED BY: A.G. DIRECTOR OF PUBLIC WORKS
			DATE: JAN 2014		
			SCALE: N.T.S.	F-49 STORM SEWER MANHOLE RISER FRAME RINGS	DRAWING NO. 50.30.25
NO.	DATE	REVISION			



PLAN



SECTION 'A - A'

MATERIAL SPECIFICATION :

- DUCTILE IRON TO CONFORM TO A.S.T.M. A536 GRADE 60-40-18
- MASS = 24KG

THE TOWN OF SYLVAN LAKE

CONSTRUCTION SPECIFICATION DRAWINGS
Manholes and Catch Basins

**F-51 CATCH BASIN GRATE
(OPTION 1)**

APPROVED BY:

A.G.

DIRECTOR OF
PUBLIC WORKS

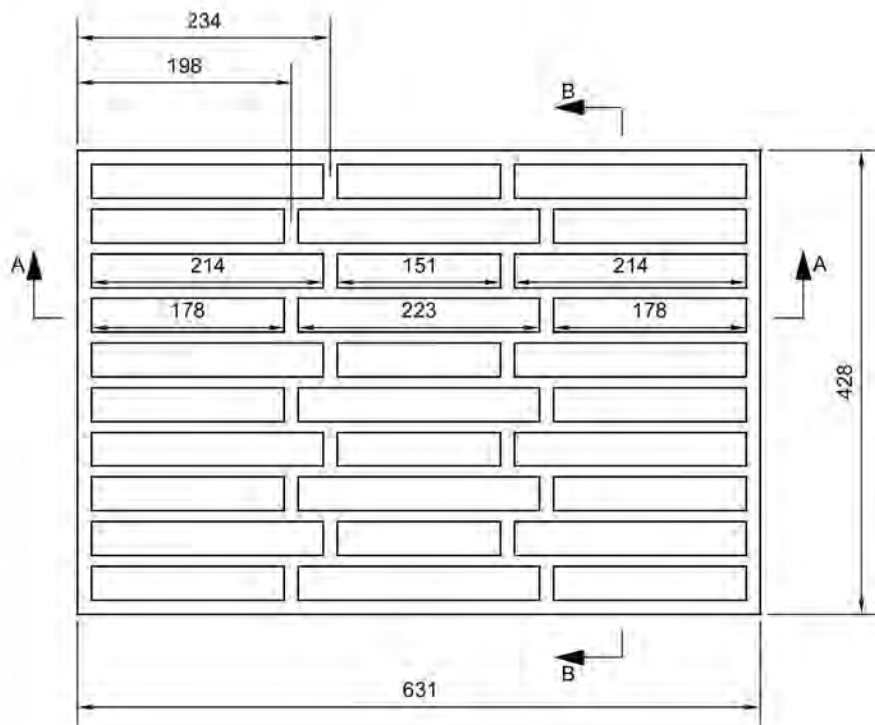
DRAWING NO.

50.30.26

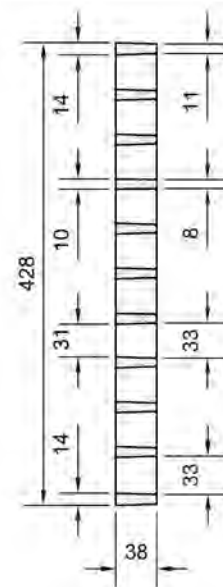
DRAWN BY:
D.K.

DATE:
JAN 2014

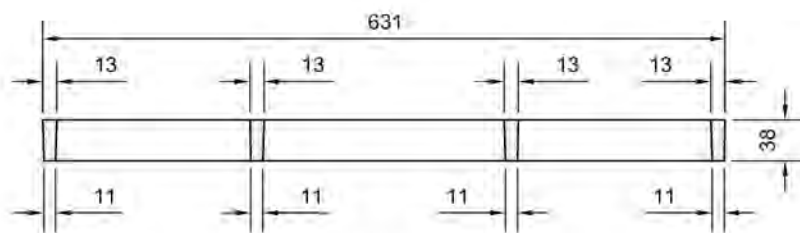
SCALE:
N.T.S.



PLAN



SECTION 'B - B'

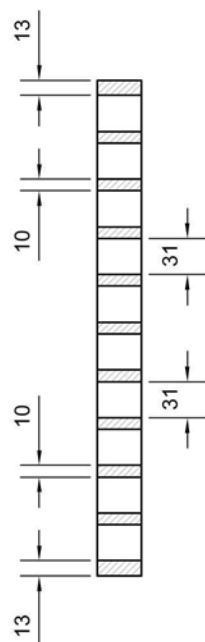


SECTION 'A - A'

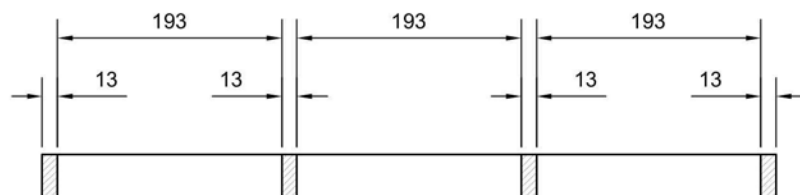
MATERIAL SPECIFICATION:

- DUCTILE IRON TO CONFORM TO A.S.T.M. A536 GRADE 60-40-18
- MASS = 24KG

			THE TOWN OF SYLVAN LAKE		
			DRAWN BY: D.K.	CONSTRUCTION SPECIFICATION DRAWINGS Manholes and Catch Basins	APPROVED BY: A.G. DIRECTOR OF PUBLIC WORKS
			DATE: JAN 2014		
			SCALE: N.T.S.	F-51 CATCH BASIN GRATE (OPTION 2)	DRAWING NO. 50.30.27
NO.	DATE	REVISION			




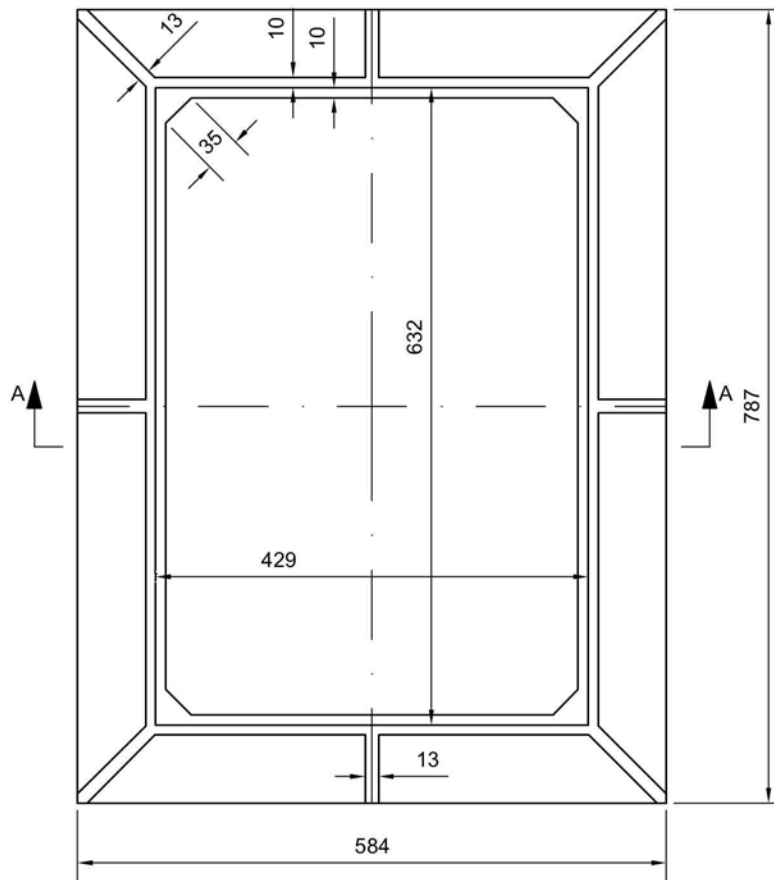
SECTION 'B - B'



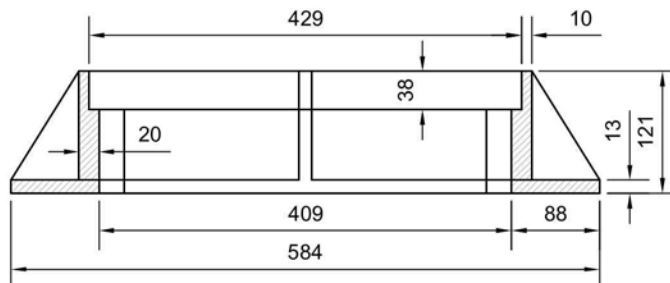
MATERIAL SPECIFICATION :

- DUCTILE IRON TO CONFORM TO A.S.T.M. A536 GRADE 60-40-18
- MASS - 24KG

			THE TOWN OF SYLVAN LAKE		
			DRAWN BY: D.K.	CONSTRUCTION SPECIFICATION DRAWINGS Manholes and Catch Basins	APPROVED BY:  DIRECTOR OF PUBLIC WORKS
			DATE: JAN 2014	F-51 CATCH BASIN GRATE (OPTION 3)	DRAWING NO. 50.30.28
			SCALE: N.T.S.		
NO.	DATE	REVISION			



PLAN



SECTION 'A - A'

MATERIAL SPECIFICATION :

- GREY CAST IRON TO CONFORM TO CLASS 20 A.S.T.M. A48
- MASS = 57KG

THE TOWN OF SYLVAN LAKE

CONSTRUCTION SPECIFICATION DRAWINGS
Manholes and Catch Basins

F-51 CATCH BASIN FRAME

APPROVED BY:

A.G.
DIRECTOR OF
PUBLIC WORKS

DRAWING NO.

50.30.29

DRAWN BY:

D.K.

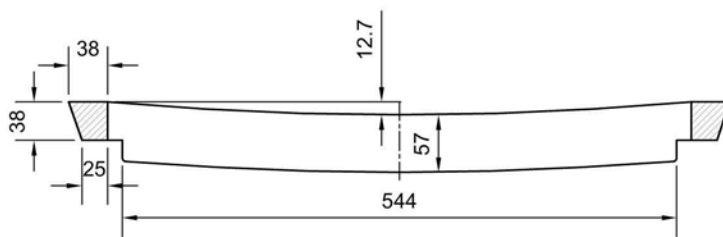
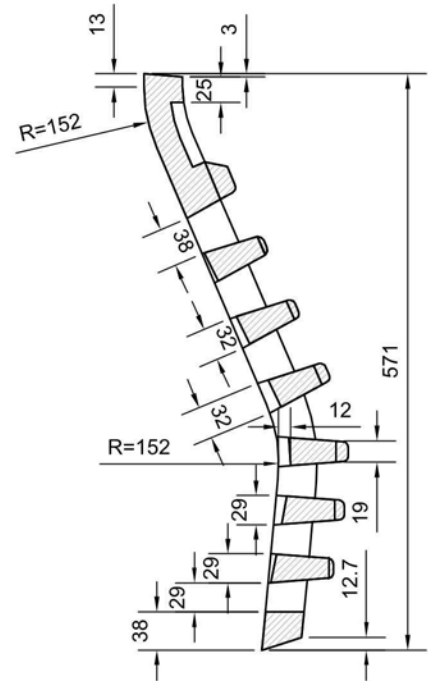
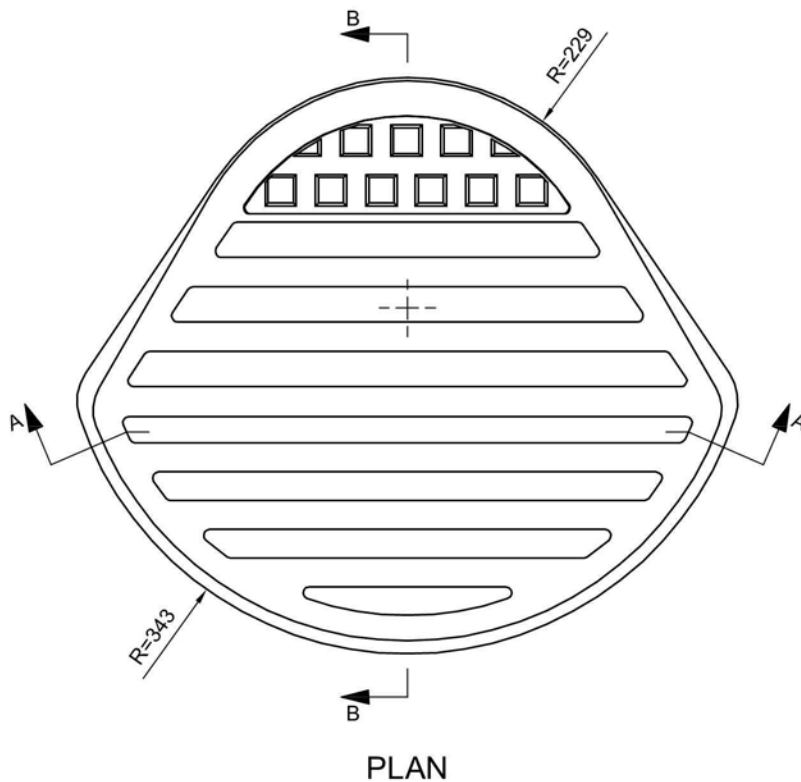
DATE:

JAN 2014

SCALE:

N.T.S.

NO.	DATE	REVISION



MATERIAL SPECIFICATION :

- GREY CAST IRON TO CONFORM TO CLASS 20 A.S.T.M. A48
- MASS = 59KG

THE TOWN OF SYLVAN LAKE

CONSTRUCTION SPECIFICATION DRAWINGS
Manholes and Catch Basins

F-33 CATCH BASIN GRATE

APPROVED BY:

A.G.
DIRECTOR OF
PUBLIC WORKS

DRAWING NO.

50.30.31

DRAWN BY:

D.K.

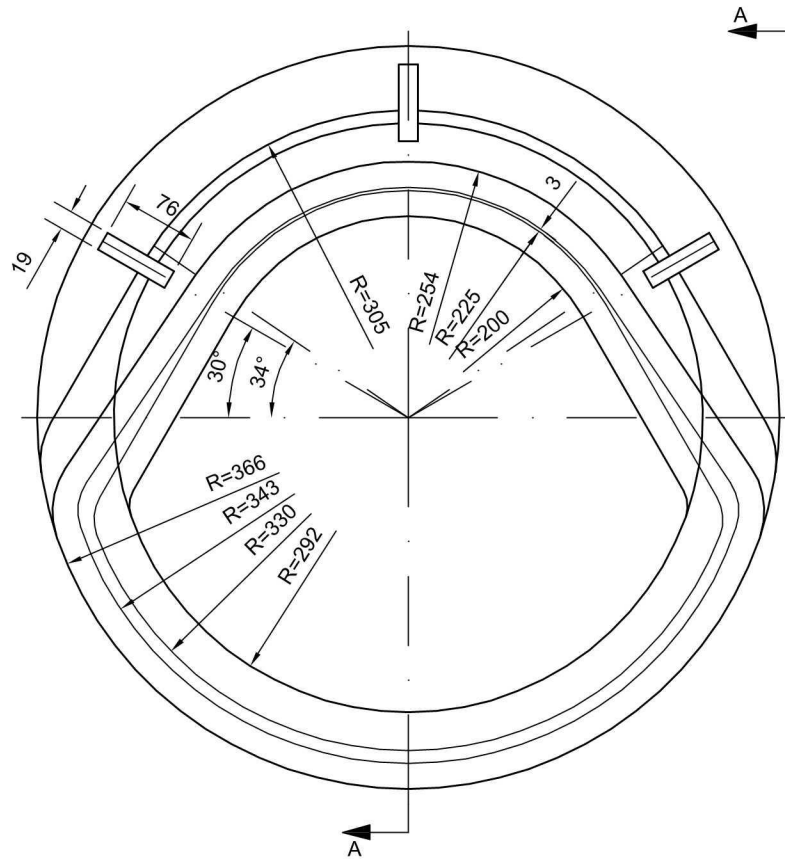
DATE:

JAN 2014

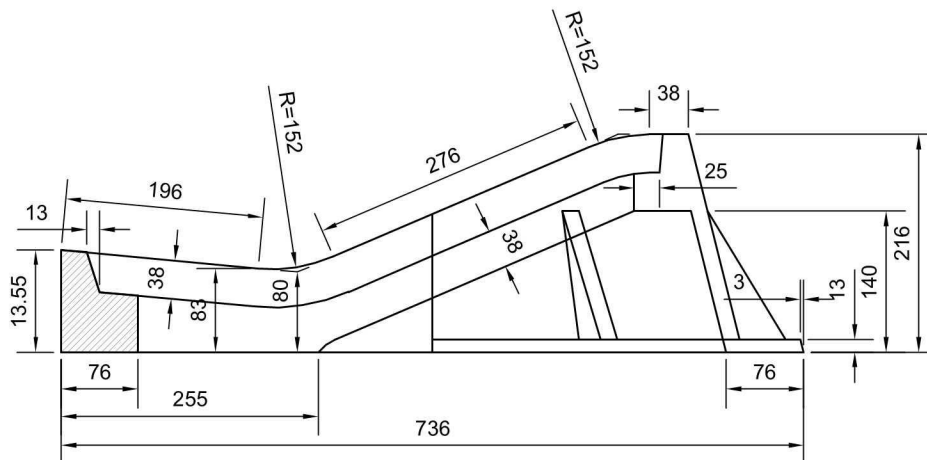
SCALE:

N.T.S.

NO. DATE REVISION



PLAN



SECTION 'A - A'

MATERIAL SPECIFICATION :

- GREY CAST IRON TO CONFORM TO CLASS 20 A.S.T.M. A48
- MASS = 98KG

THE TOWN OF SYLVAN LAKE

DRAWN BY:
D.K.

CONSTRUCTION SPECIFICATION DRAWINGS
Manholes and Catch Basins

APPROVED BY:

DATE:
JAN 2014

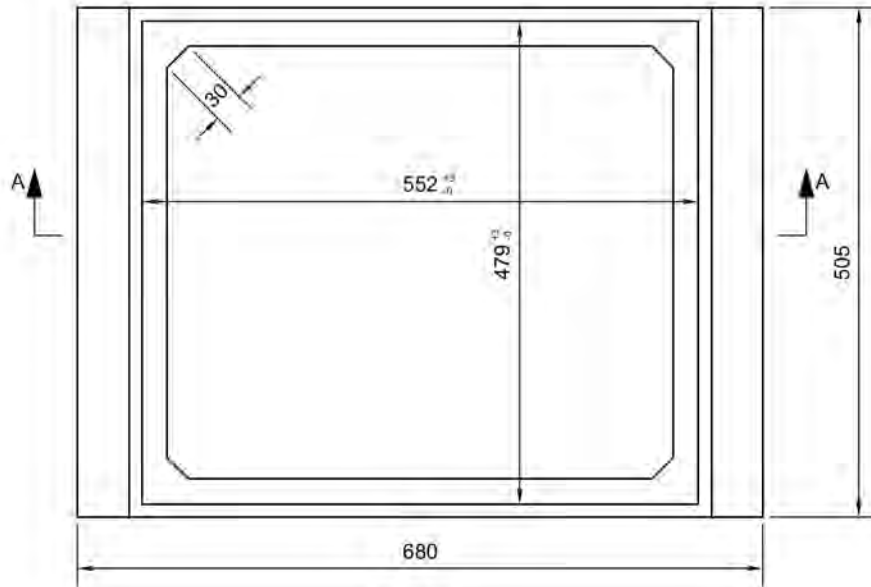
SCALE:
N.T.S.

F-33 CATCH BASIN FRAME

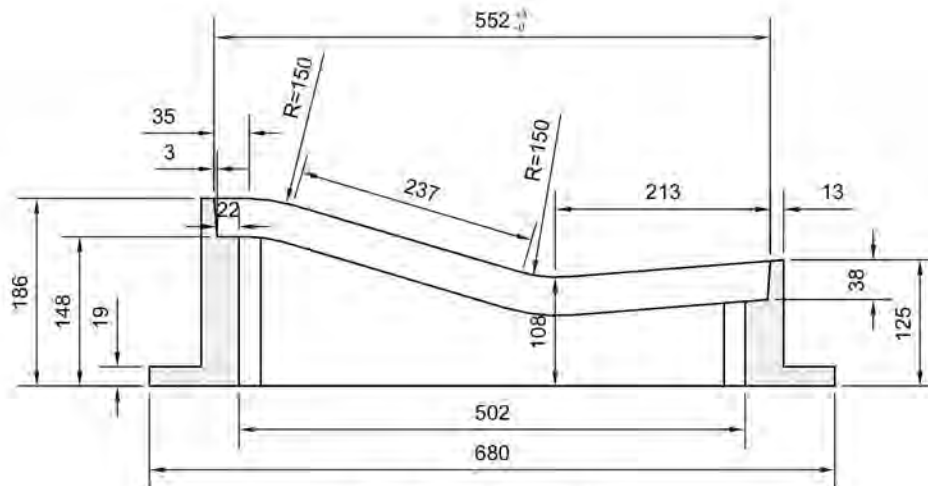
A.G.
DIRECTOR OF
PUBLIC WORKS

DRAWING NO.
50.30.32

NO.	DATE	REVISION



PLAN



SECTION 'A - A'

MATERIAL SPECIFICATIONS :

- GREY CAST IRON TO CONFORM TO CLASS 25B A.S.T.M. A48

THE TOWN OF SYLVAN LAKE

DRAWN BY:
D.K.

DATE:
JAN 2014

SCALE:
N.T.S.

CONSTRUCTION SPECIFICATION DRAWINGS
Manholes and Catch Basins

SK-7 CATCH BASIN
SINGLE GRATE FRAME

APPROVED BY:

A.G.
DIRECTOR OF
PUBLIC WORKS


DRAWING NO.

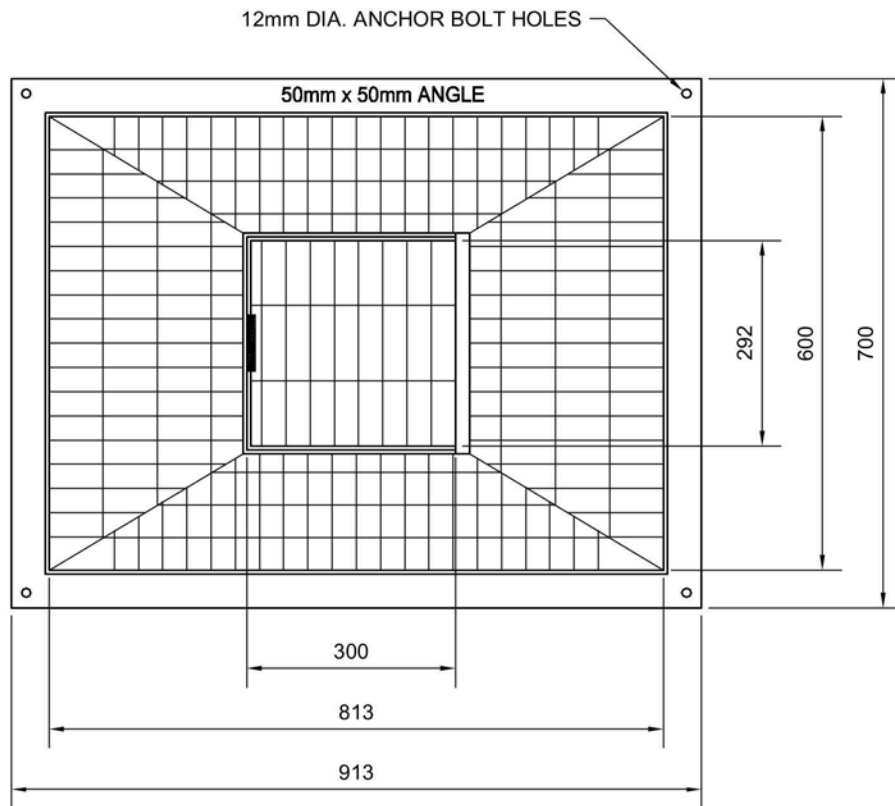
50.30.33

NO.	DATE	REVISION

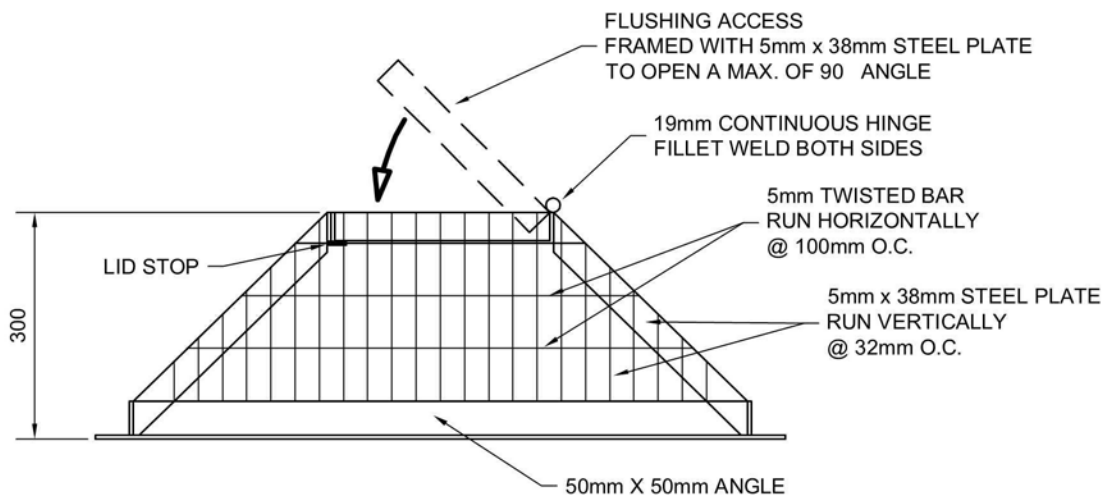


- DUCTILE IRON TO CONFORM TO A S T M A 536 GRADE 60-40-18

			THE TOWN OF SYLVAN LAKE		
			DRAWN BY: D.K.	CONSTRUCTION SPECIFICATION DRAWINGS Manholes and Catch Basins	APPROVED BY:  DIRECTOR OF PUBLIC WORKS
			DATE: JAN 2014	K-7 CATCH BASIN GRATE FOR SINGLE OR DOUBLE FRAME	DRAWING NO. 50.30.35
			SCALE: N.T.S.		
NO.	DATE	REVISION			



PLAN VIEW



ELEVATION VIEW

THE TOWN OF SYLVAN LAKE

DRAWN BY:
D.K.

DATE:
JAN 2014

SCALE:
N.T.S.

CONSTRUCTION SPECIFICATION DRAWINGS
Manholes and Catch Basins

TRASH GRATE

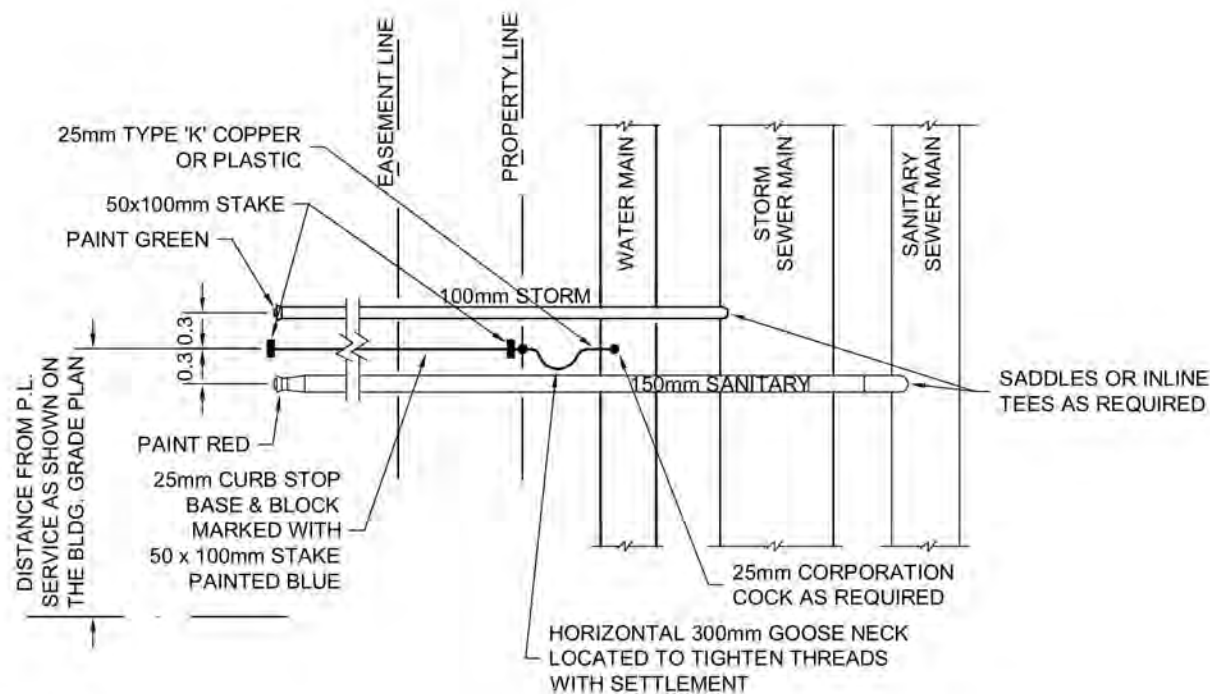
APPROVED BY:

A.G.
DIRECTOR OF
PUBLIC WORKS

DRAWING NO.

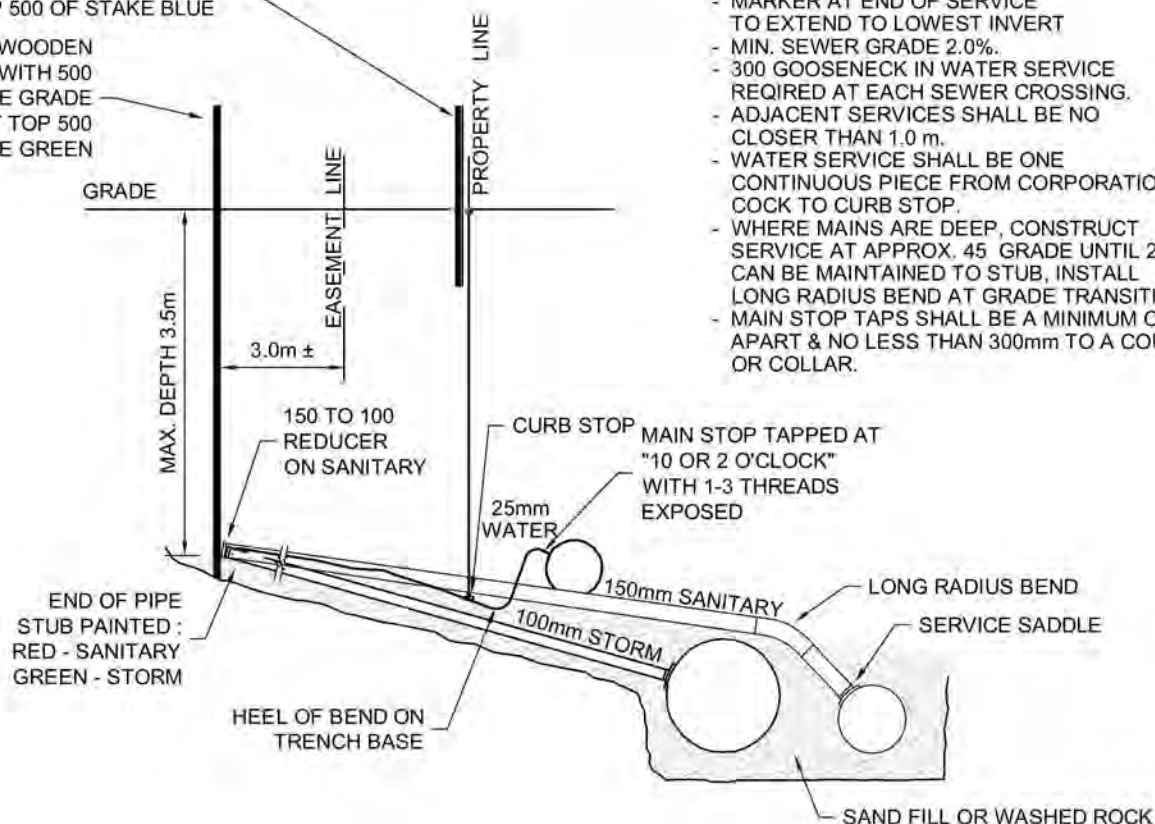
50.30.36

NO.	DATE	REVISION



50 x 100 WOODEN MARKER WITH 500 ABOVE GRADE PAINT TOP 500 OF STAKE BLUE

50 x 100 WOODEN MARKER WITH 500 ABOVE GRADE PAINT TOP 500 OF STAKE GREEN



NOTE:

- MARKER AT END OF SERVICE TO EXTEND TO LOWEST INVERT
- MIN. SEWER GRADE 2.0%.
- 300 GOOSENECK IN WATER SERVICE REQUIRED AT EACH SEWER CROSSING.
- ADJACENT SERVICES SHALL BE NO CLOSER THAN 1.0 m.
- WATER SERVICE SHALL BE ONE CONTINUOUS PIECE FROM CORPORATION COCK TO CURB STOP.
- WHERE MAINS ARE DEEP, CONSTRUCT SERVICE AT APPROX. 45° GRADE UNTIL 2 - 5% CAN BE MAINTAINED TO STUB, INSTALL LONG RADIUS BEND AT GRADE TRANSITION.
- MAIN STOP TAPS SHALL BE A MINIMUM OF 600mm APART & NO LESS THAN 300mm TO A COUPLING OR COLLAR.

THE TOWN OF SYLVAN LAKE

DRAWN BY:
D.K.

DATE:
JAN 2014

SCALE:
N.T.S.

CONSTRUCTION SPECIFICATION DRAWINGS
Manholes and Catch Basins

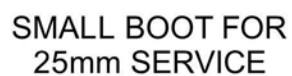
TYPICAL RESIDENTIAL
SERVICE CONNECTION


APPROVED BY:

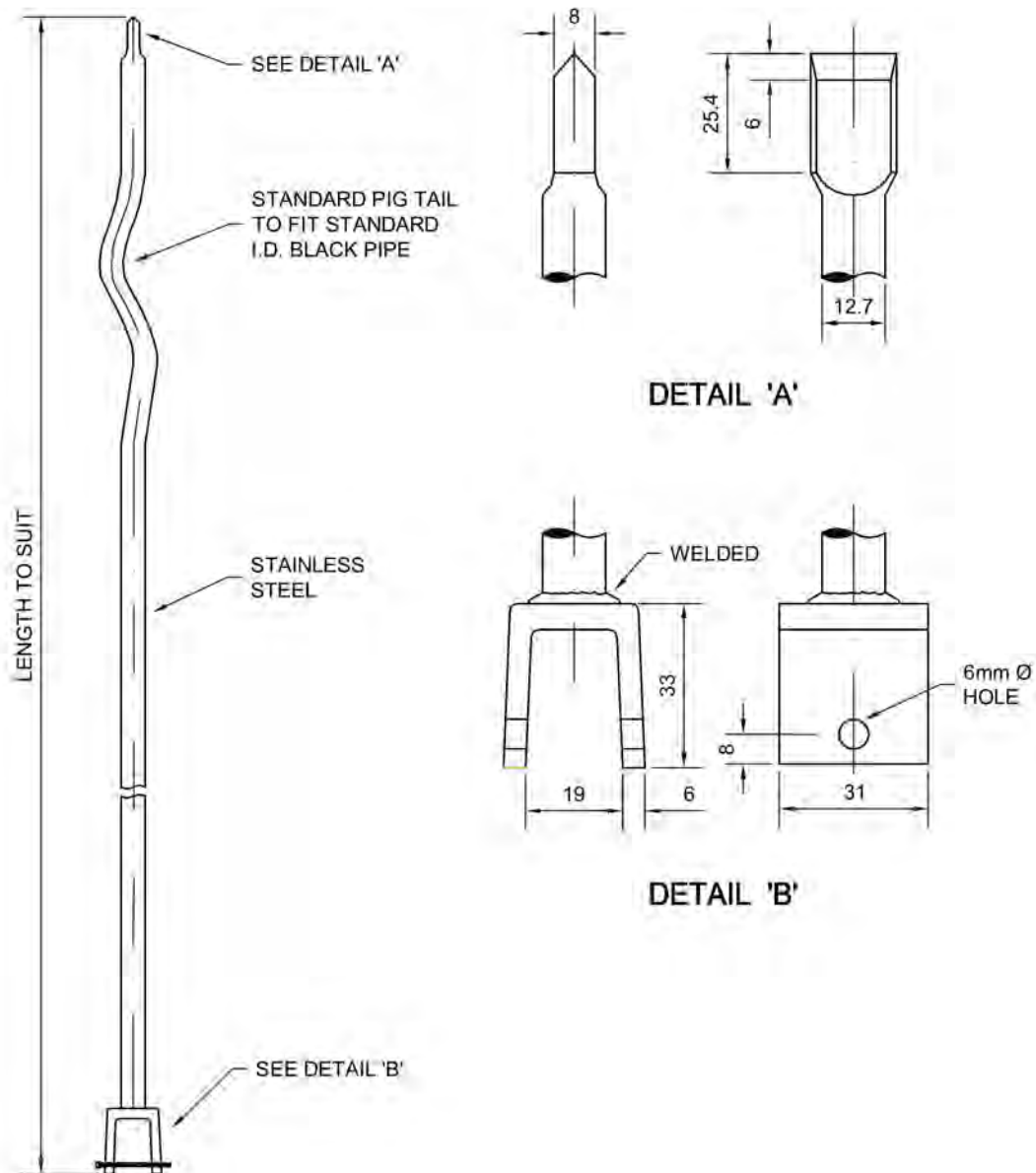
A.G.
DIRECTOR OF
PUBLIC WORKS

DRAWING NO.

50.40.01



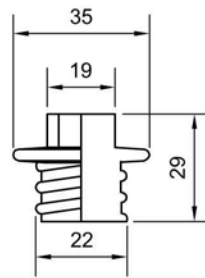
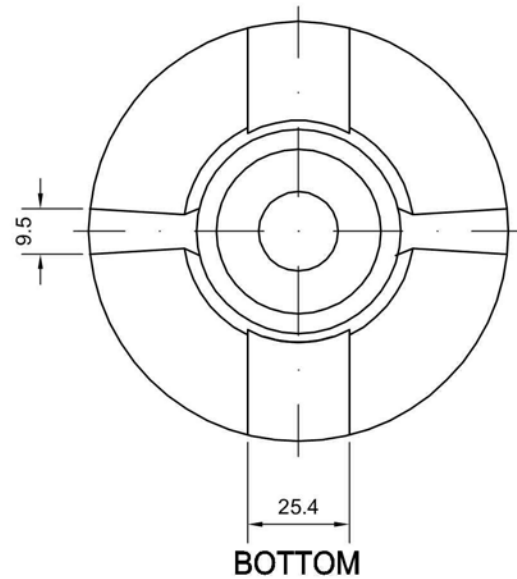
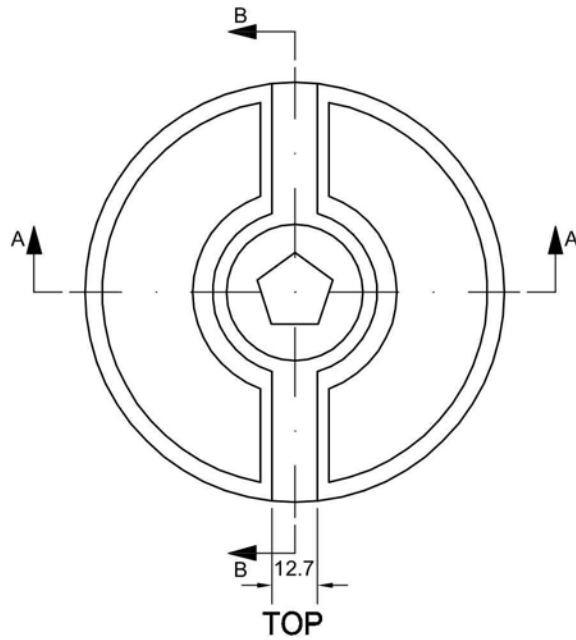
			THE TOWN OF SYLVAN LAKE		
			DRAWN BY: D.K.	CONSTRUCTION SPECIFICATION DRAWINGS Manholes and Catch Basins	APPROVED BY:  DIRECTOR OF PUBLIC WORKS
			DATE: JAN 2014	STANDARD TOP ADJUSTMENT SERVICE BOX AND BOOT FOR 25mm, 38mm & 50mm SERVICE	DRAWING NO. 50.40.02
			SCALE: N.T.S.		
NO.	DATE	REVISION			



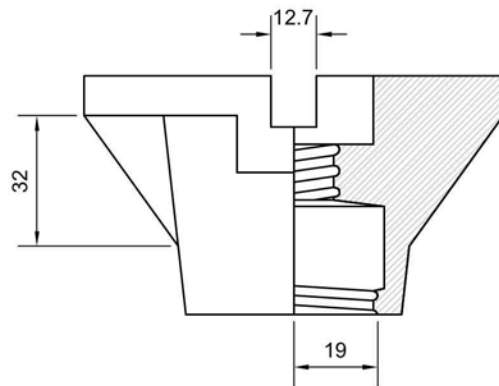
MATERIAL SPECIFICATION :

- DIN 50.049 / 2.3 TYPE 304 HRR STAINLESS ROD

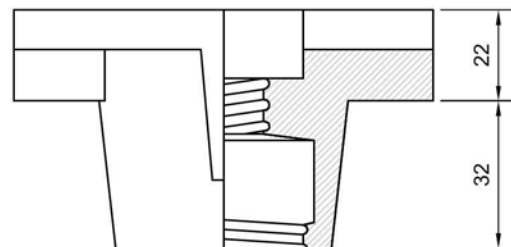
			THE TOWN OF SYLVAN LAKE		
			DRAWN BY: D.K.	CONSTRUCTION SPECIFICATION DRAWINGS Manholes and Catch Basins	APPROVED BY:  DIRECTOR OF PUBLIC WORKS
			DATE JAN 2014	12.7mm STAINLESS STEEL SERVICE BOX ROD	DRAWING NO. 50.40.03
			SCALE: N.T.S.		
NO.	DATE	REVISION			



CAP BOLT



SECTION 'A - A'



SECTION 'B - B'

THE TOWN OF SYLVAN LAKE

DRAWN BY:
D.K.

DATE:
JAN 2014

SCALE:
N.T.S.

CONSTRUCTION SPECIFICATION DRAWINGS
Manholes and Catch Basins

SERVICE BOX CAP

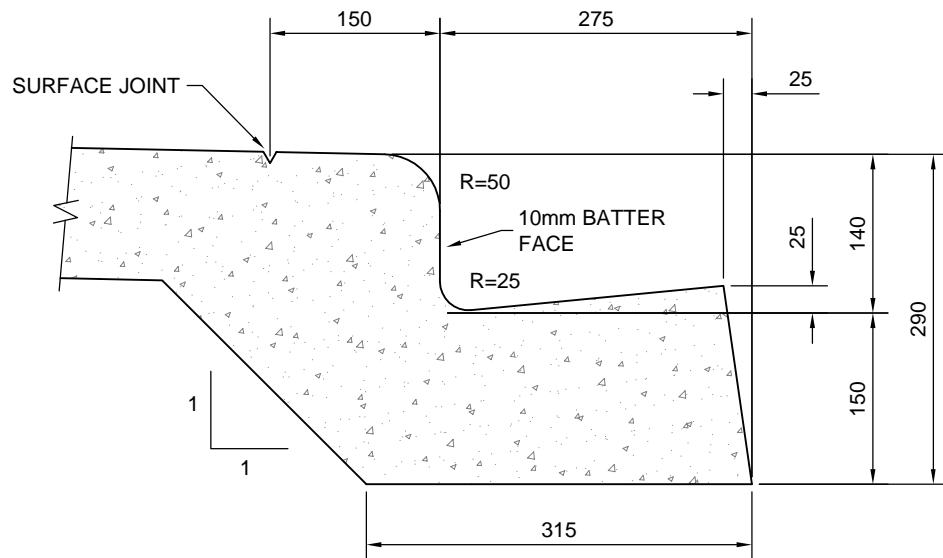
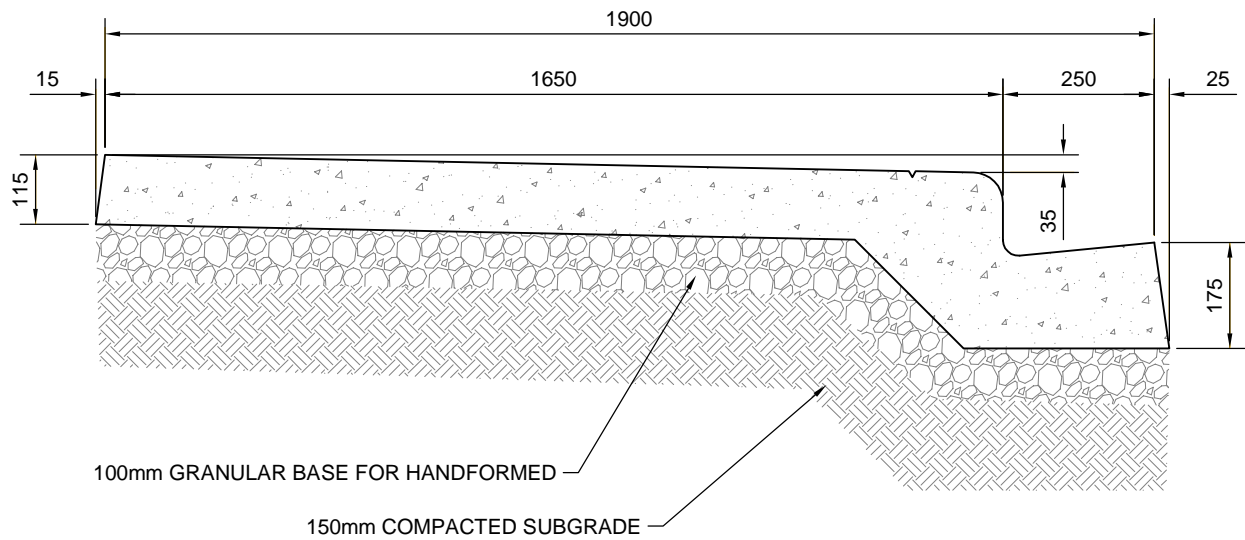
APPROVED BY:

A.G.
DIRECTOR OF
PUBLIC WORKS

DRAWING NO.

50.40.04

NO.	DATE	REVISION



NOTE : BATTER NOT REQUIRED FOR HANDFORMED.

THE TOWN OF SYLVAN LAKE

DRAWN BY:

M.M.

DATE:

2019

SCALE:

N.T.S.

CONSTRUCTION SPECIFICATION DRAWINGS
Concrete Work

1.5m STANDARD MONOLITHIC
SIDEWALK

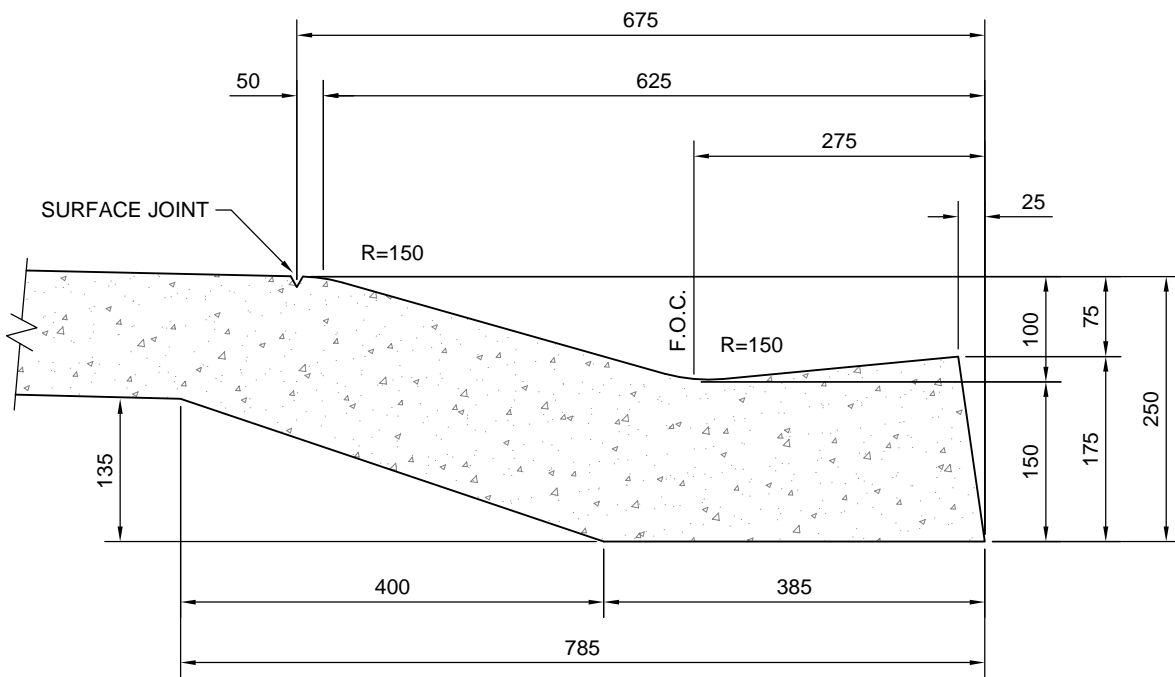
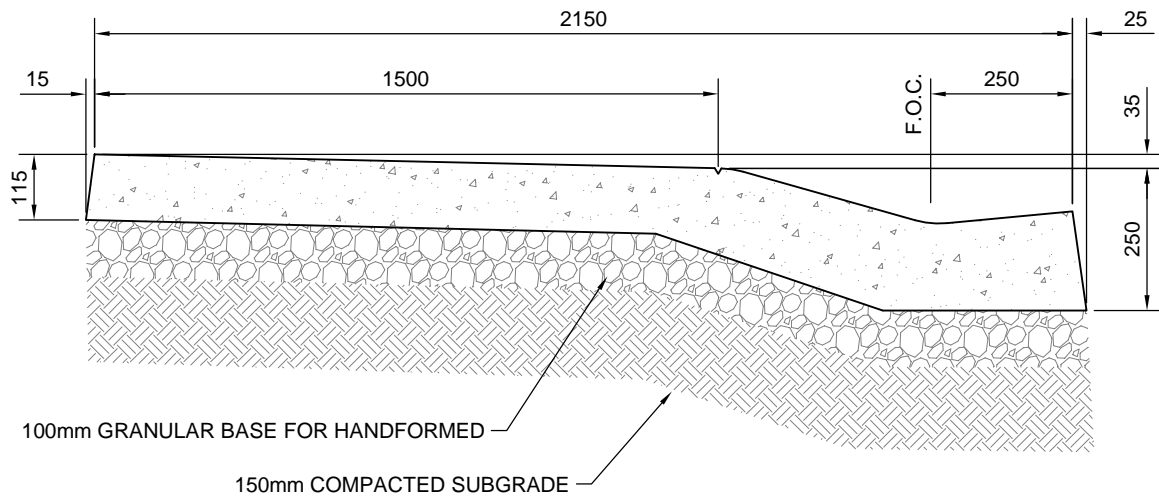
APPROVED BY:


[Signature]
DIRECTOR OF
PUBLIC WORKS

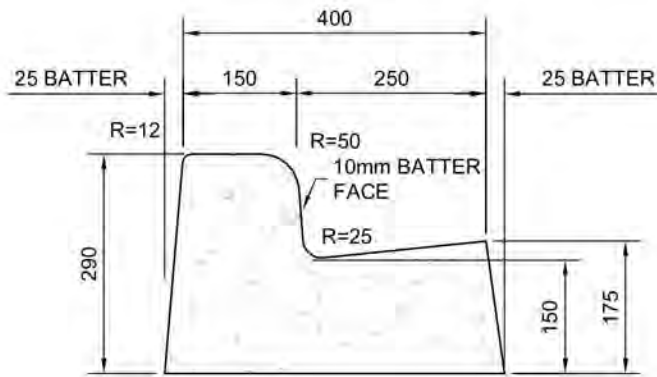
DRAWING NO.

50.60.01

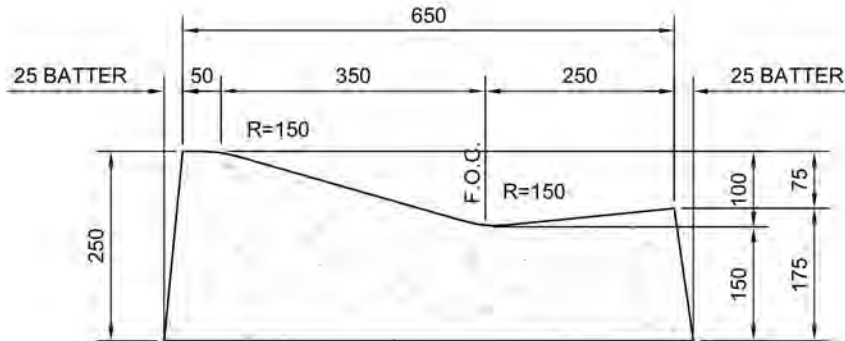
NO.	DATE	REVISION
1	2019	Revised clear walking width to 1.5m



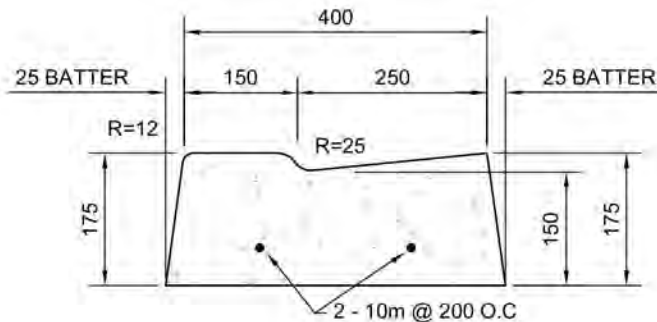
			THE TOWN OF SYLVAN LAKE		
			DRAWN BY:	CONSTRUCTION SPECIFICATION DRAWINGS Concrete Work	APPROVED BY:  DIRECTOR OF PUBLIC WORKS
			M.M.		
			DATE:		
			2019	1.5m ROLLED MONOLITHIC SIDEWALK	DRAWING NO. 50.60.02
			SCALE:		
			N.T.S.		
1	2019	Revised clear walking width to 1.5m			
NO.	DATE	REVISION			



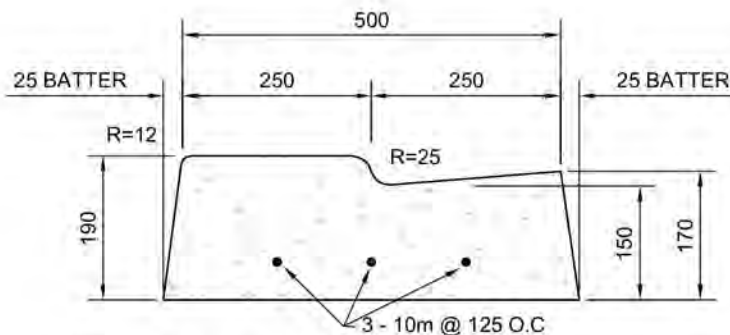
STANDARD
CURB & GUTTER



ROLLED
CURB & GUTTER



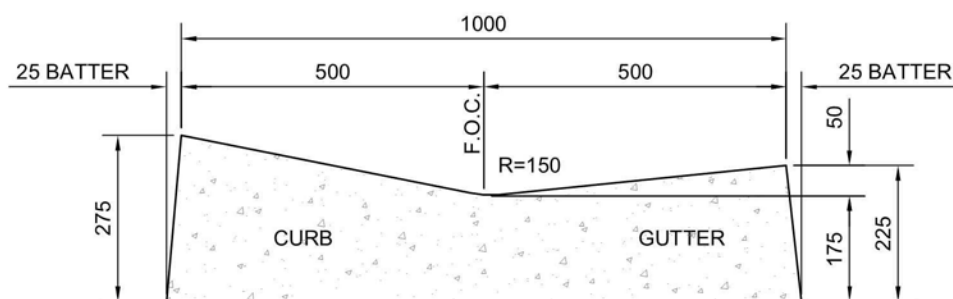
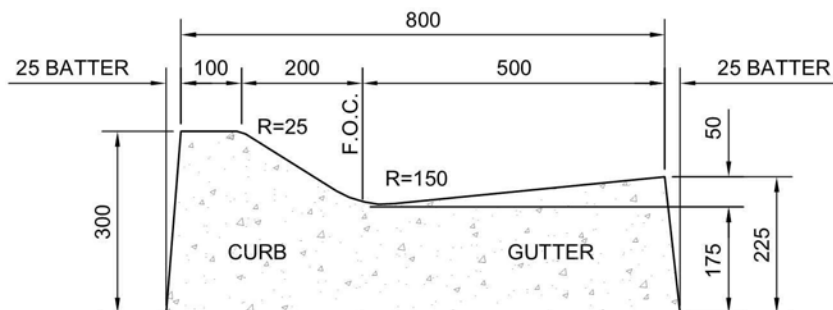
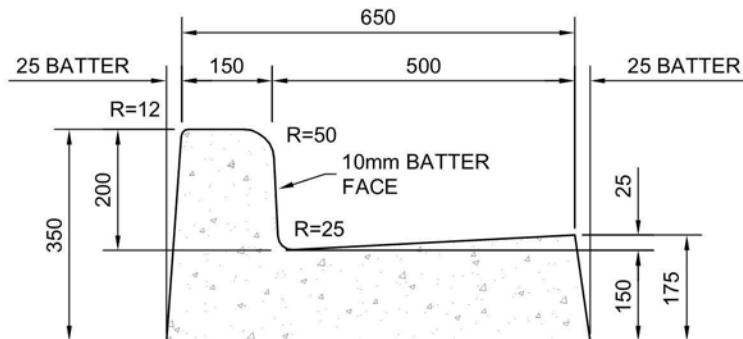
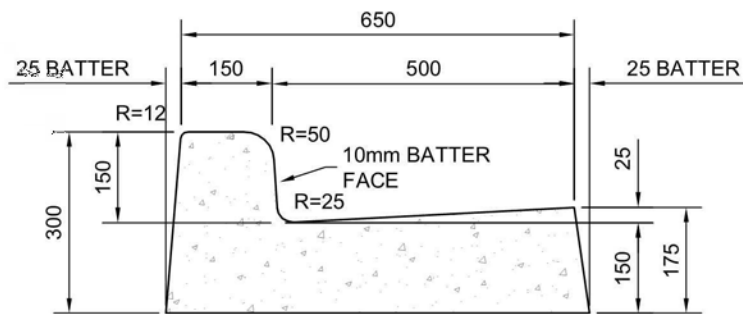
RESIDENTIAL
CURB & GUTTER
CROSSING




COMMERCIAL / INDUSTRIAL
CURB & GUTTER
CROSSING

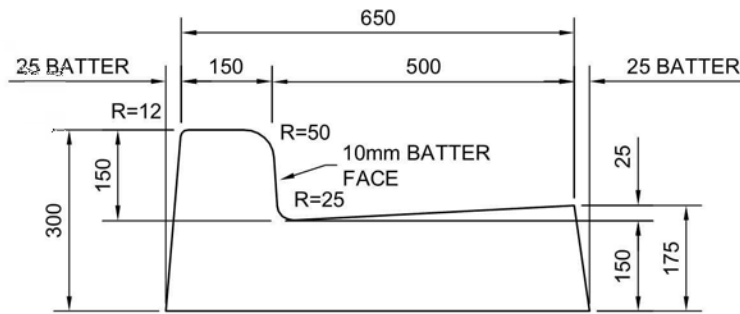
NOTE :
BATTER NOT REQUIRED FOR HANDFORMED

			THE TOWN OF SYLVAN LAKE		
			DRAWN BY: D.K.	CONSTRUCTION SPECIFICATION DRAWINGS Concrete Work	APPROVED BY: A.G. DIRECTOR OF PUBLIC WORKS
			DATE JAN 2014	250mm CURB & GUTTER	DRAWING NO. 50.60.04
			SCALE: N.T.S.		
NO.	DATE	REVISION			

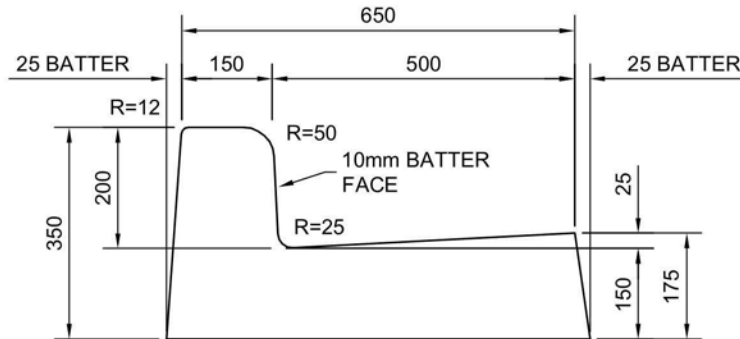


NOTE :
BATTER NOT REQUIRED FOR HANDEFORMED

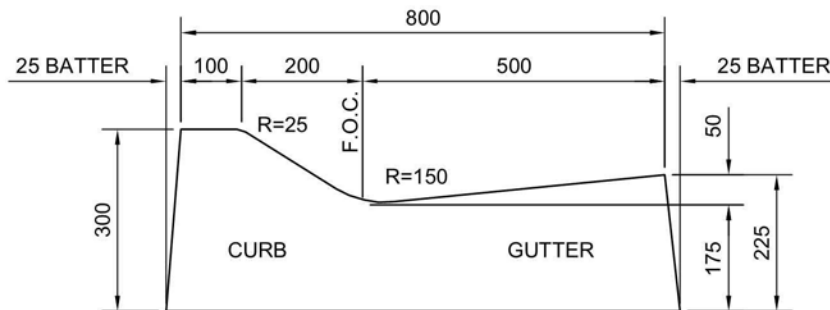
			THE TOWN OF SYLVAN LAKE		
			DRAWN BY: D.K.	CONSTRUCTION SPECIFICATION DRAWINGS Concrete Work	APPROVED BY:  DIRECTOR OF PUBLIC WORKS
			DATE: JAN 2014	500mm CURB & GUTTER FOR ARTERIAL ROADWAYS	DRAWING NO. 50.60.05
			SCALE: N.T.S.		
NO.	DATE	REVISION			



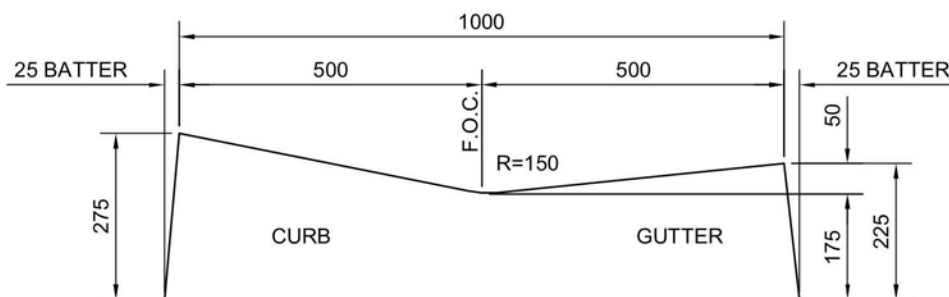
150mm BARRIER
CURB & GUTTER



200mm BARRIER
CURB & GUTTER



SEMI-MOUNTABLE
CURB & GUTTER



MOUNTABLE
CURB & GUTTER

NOTE :
BATTER NOT REQUIRED FOR HANDFORMED

THE TOWN OF SYLVAN LAKE

DRAWN BY:
D.K.

CONSTRUCTION SPECIFICATION DRAWINGS
Concrete Work

APPROVED BY:

A.G.
DIRECTOR OF
PUBLIC WORKS

DATE:
JAN 2014

SCALE:
N.T.S.


500mm REVERSED
CURB & GUTTER
FOR ARTERIAL ROADWAYS


DRAWING NO.

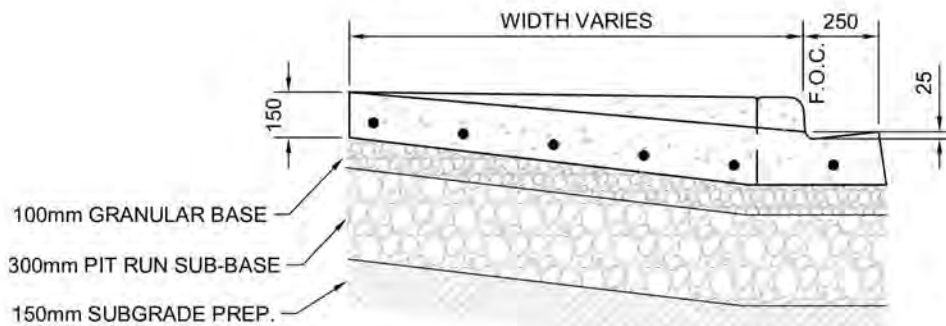
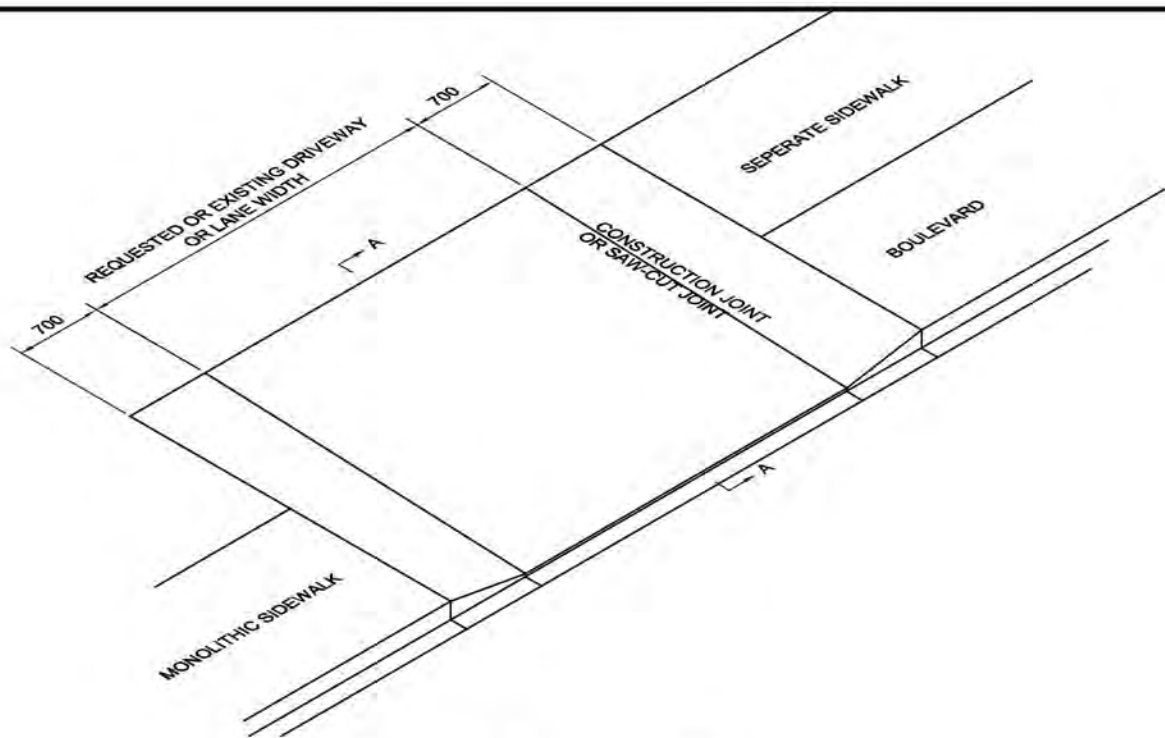
50.60.06

NO. DATE REVISION



			THE TOWN OF SYLVAN LAKE		
			DRAWN BY: D.K.	CONSTRUCTION SPECIFICATION DRAWINGS Concrete Work	APPROVED BY:  DIRECTOR OF PUBLIC WORKS
			DATE: JAN 2014	PINNED CONCRETE CURB	DRAWING NO. 50.60.07
			SCALE: N.T.S.		
NO.	DATE	REVISION			

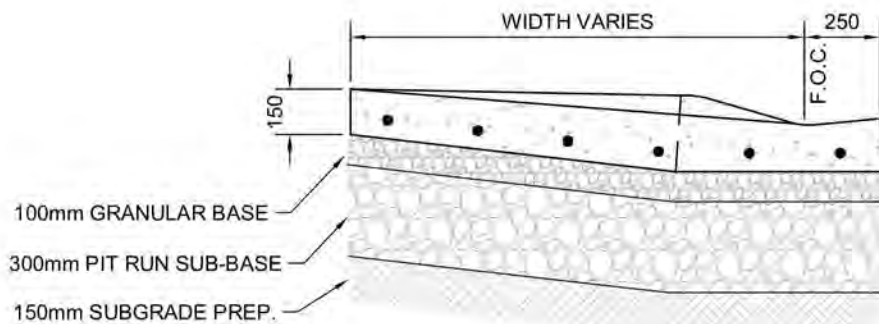
			THE TOWN OF SYLVAN LAKE		
			DRAWN BY: D.K.	CONSTRUCTION SPECIFICATION DRAWINGS Concrete Work	APPROVED BY:  DIRECTOR OF PUBLIC WORKS
			DATE: JAN 2014	CURB & GUTTER WIDENING FOR F-33, K-1 & DK-7 CATCH BASIN INSTALLATION	DRAWING NO. 50.60.08
			SCALE: N.T.S.		
NO.	DATE	REVISION			



SECTION 'A - A'
STANDARD CURB & GUTTER

NOTE :

- 27.5 MPa CONCRETE.
- ALL DIMENSIONS NOMINAL.
- REINFORCING STEEL TO BE 10M @ 300mm O.C..
- ALL LANE AND DRIVEWAY CROSSINGS ARE TO BE REINFORCED.



SECTION 'A - A'
ROLLED CURB & GUTTER

THE TOWN OF SYLVAN LAKE

DRAWN BY:
D.K.

CONSTRUCTION SPECIFICATION DRAWINGS
Concrete Work

APPROVED BY:

A.G.
DIRECTOR OF
PUBLIC WORKS

DATE:
JAN 2014

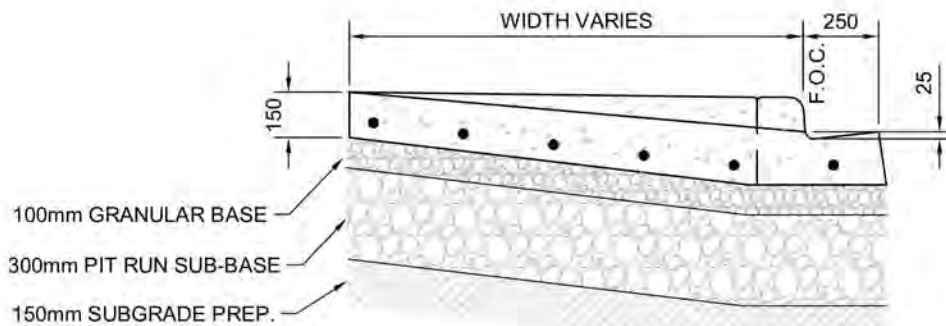
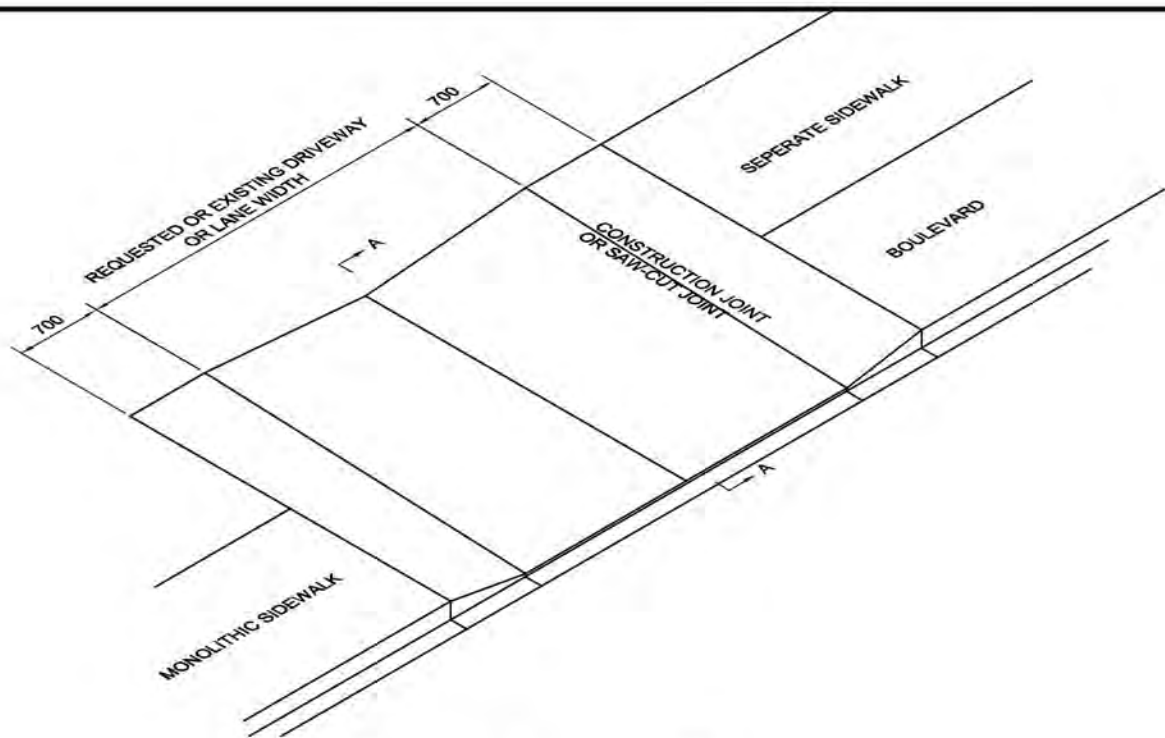
SCALE:
N.T.S.

TYPICAL MONOLITHIC AND
SEPERATE LANE / DRIVEWAY
CROSSING

DRAWING NO.

50.60.09

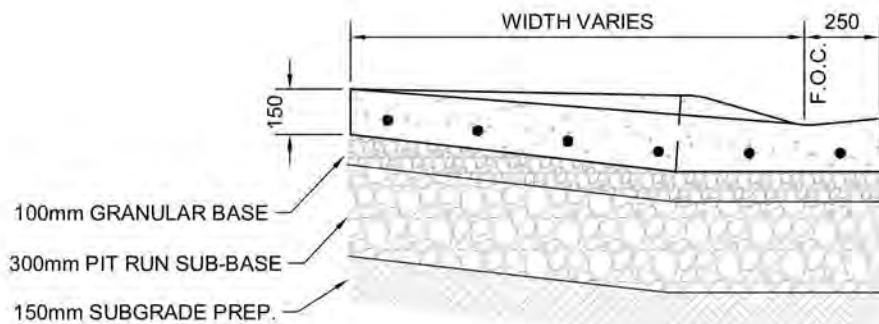
NO.	DATE	REVISION



SECTION 'A - A'
STANDARD CURB & GUTTER

NOTE :

- 27.5 MPa CONCRETE.
- ALL DIMENSIONS NOMINAL.
- REINFORCING STEEL TO BE 10M @ 300mm O.C..
- ALL LANE AND DRIVEWAY CROSSINGS ARE TO BE REINFORCED.



SECTION 'A - A'
ROLLED CURB & GUTTER

THE TOWN OF SYLVAN LAKE

DRAWN BY:
D.K.

CONSTRUCTION SPECIFICATION DRAWINGS
Concrete Work

APPROVED BY:

A.G.
DIRECTOR OF
PUBLIC WORKS

DATE:
JAN 2014

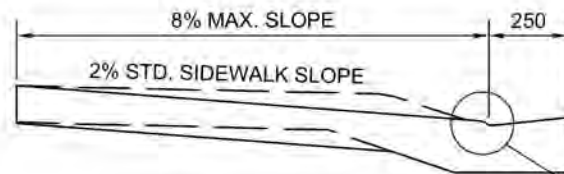
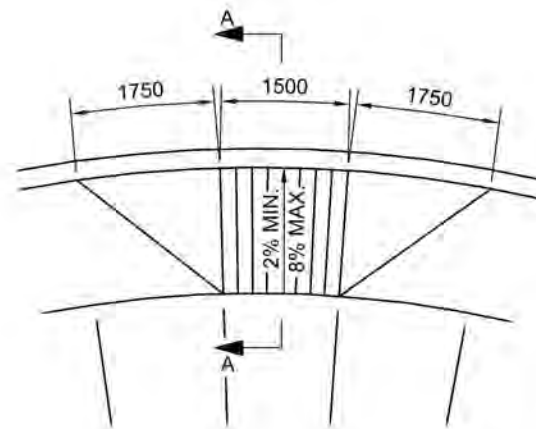
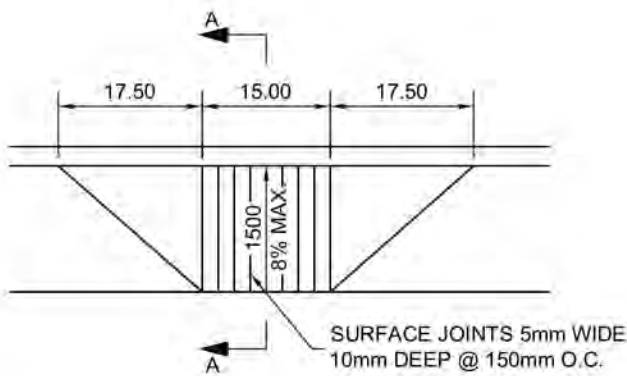
TYPICAL MONOLITHIC AND
SEPERATE PAVED LANE
CROSSING

SCALE:
N.T.S.

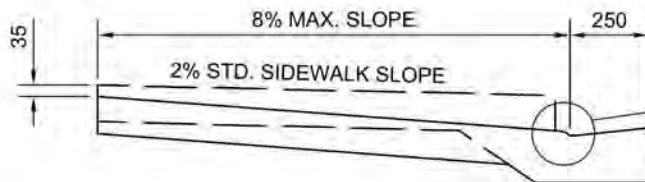
DRAWING NO.

50.60.10

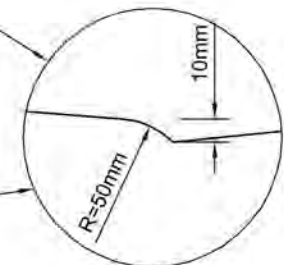
NO.	DATE	REVISION



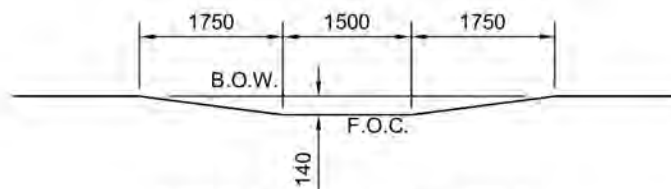
SECTION 'A - A'
ROLLED MONOLITHIC SIDEWALK




SECTION 'A - A'
STANDARD MONOLITHIC SIDEWALK

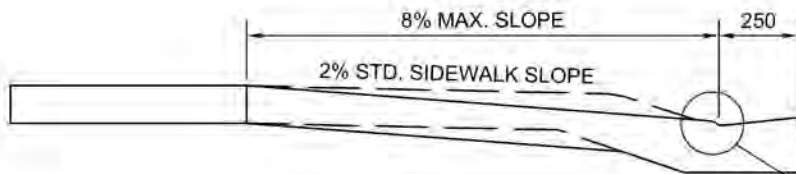
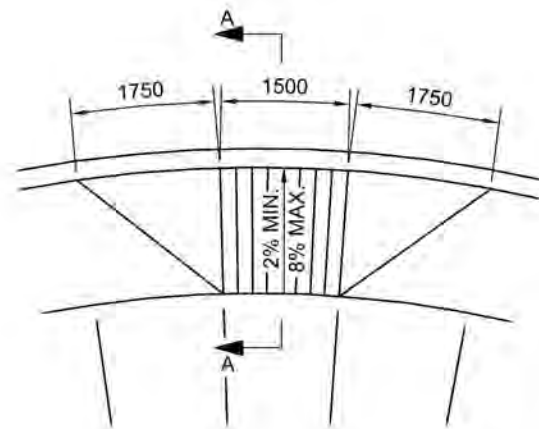
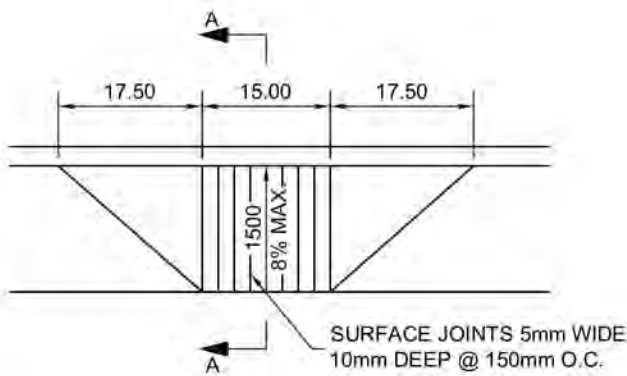


DETAIL

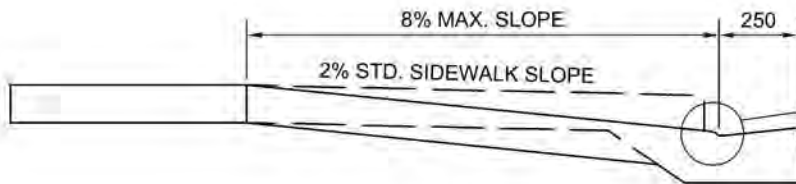


BACK OF WALK PROFILE
STANDARD MONOLITHIC SIDEWALK

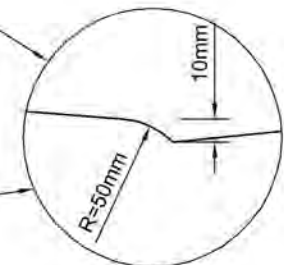
			THE TOWN OF SYLVAN LAKE		
			DRAWN BY: D.K.	CONSTRUCTION SPECIFICATION DRAWINGS Concrete Work	APPROVED BY:  DIRECTOR OF PUBLIC WORKS
			DATE JAN 2014	1.5m MONOLITHIC SIDEWALK PARAPLEGIC RAMP	DRAWING NO. 50.60.11
			SCALE: N.T.S.		
NO.	DATE	REVISION			



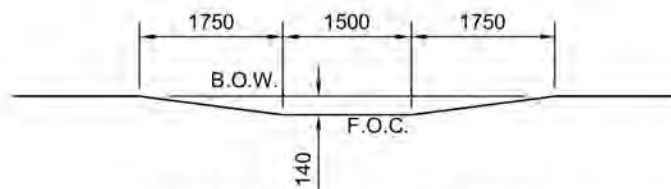
SECTION 'A - A'
ROLLED MONOLITHIC SIDEWALK



SECTION 'A - A'
STANDARD MONOLITHIC SIDEWALK



DETAIL



BACK OF WALK PROFILE
STANDARD MONOLITHIC SIDEWALK

THE TOWN OF SYLVAN LAKE

DRAWN BY:
D.K.

CONSTRUCTION SPECIFICATION DRAWINGS
Concrete Work

APPROVED BY:

A.G.

DIRECTOR OF
PUBLIC WORKS

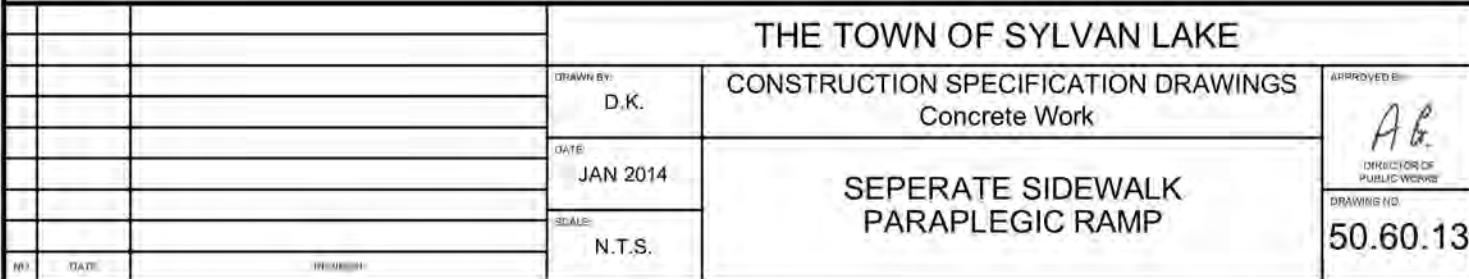
DATE:
JAN 2014

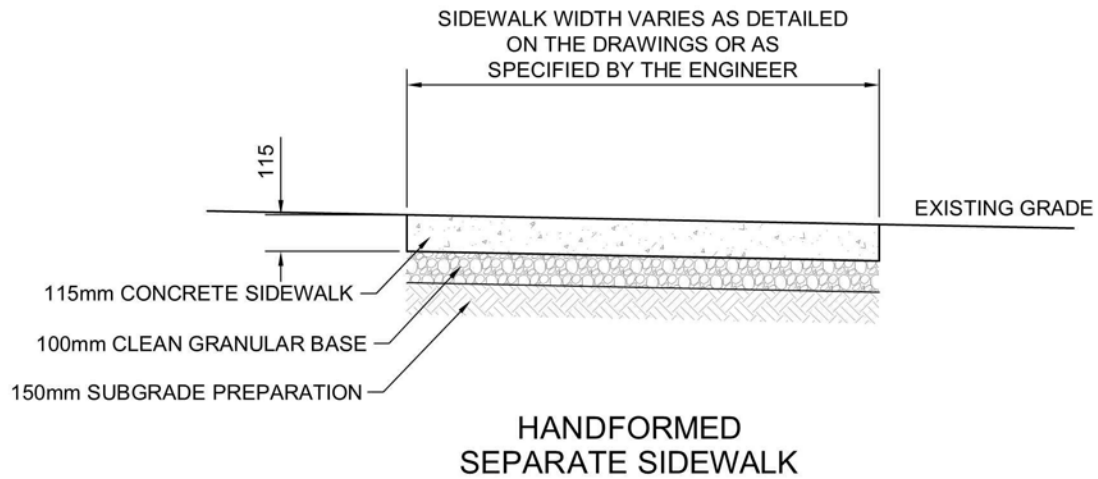
SCALE:
N.T.S.

2.5m MONOLITHIC SIDEWALK
PARAPLEGIC RAMP

DRAWING NO.

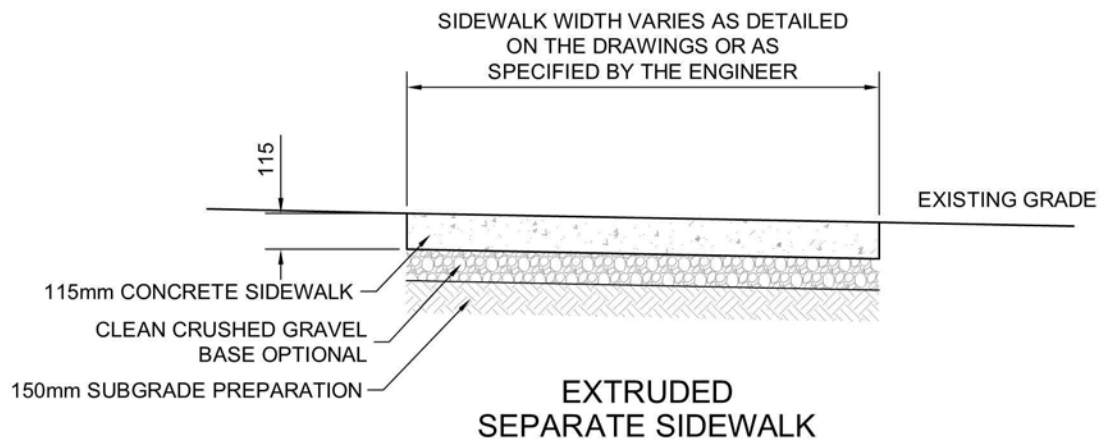
50.60.12





NOTE :

- CONCRETE TO BE 27.5 MPa.
- FOR COMMERCIAL SIDEWALK CROSSINGS, SLAB THICKNESS TO BE 150mm.
- ALL DIMENSIONS NOMINAL.



THE TOWN OF SYLVAN LAKE

DRAWN BY:
D.K.

CONSTRUCTION SPECIFICATION DRAWINGS
Concrete Work

APPROVED BY:

DATE:
JAN 2014

**HANDFORMED AND EXTRUDED
SEPERATE SIDEWALK
BASE DETAIL**

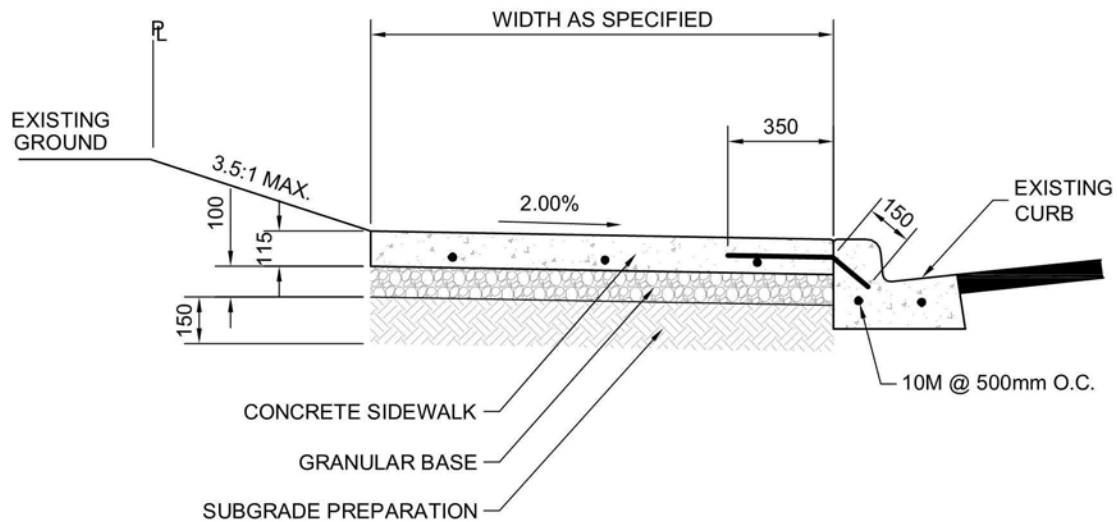
A.G.
DIRECTOR OF
PUBLIC WORKS

SCALE:
N.T.S.

DRAWING NO.

50.60.14

NO.	DATE	REVISION



NOTE :

- CONCRETE TO BE 27.5 MPa.
- CONCRETE THICKNESS TO BE 150mm FOR COMMERCIAL SIDEWALK CROSSING.
- 50mm MINIMUM CONCRETE COVER OVER OR UNDER REINFORCING.

THE TOWN OF SYLVAN LAKE

DRAWN BY:
D.K.

CONSTRUCTION SPECIFICATION DRAWINGS
Concrete Work

APPROVED BY:

DATE:
JAN 2014

SEPERATE SIDEWALK ADJACENT
TO EXISTING CURB AND GUTTER

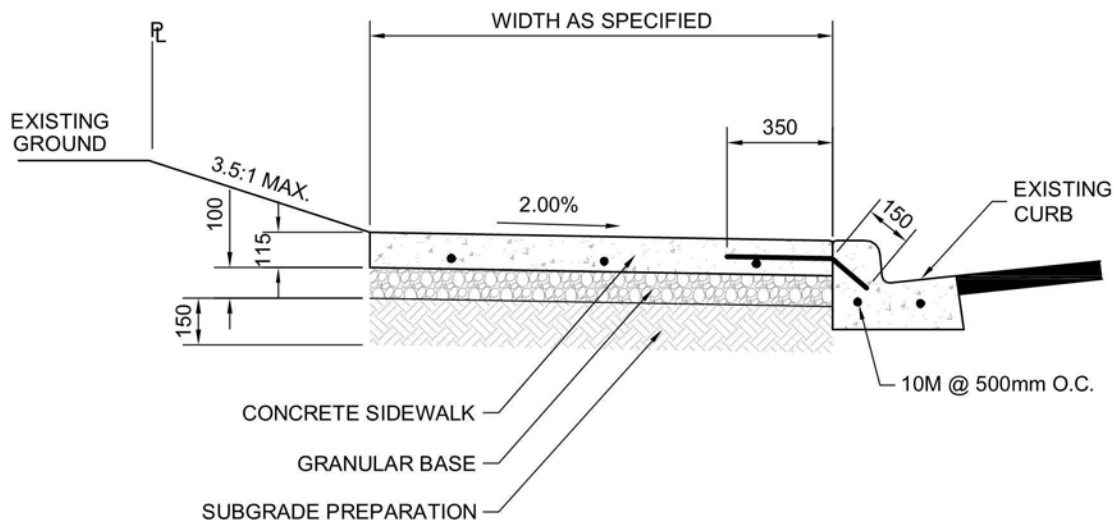
A.G.
DIRECTOR OF
PUBLIC WORKS

SCALE:
N.T.S.


DRAWING NO.

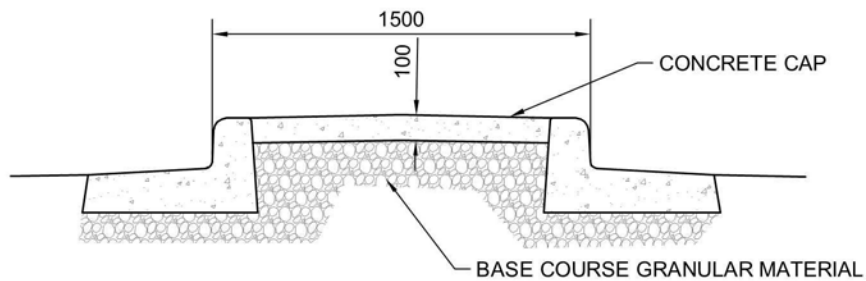
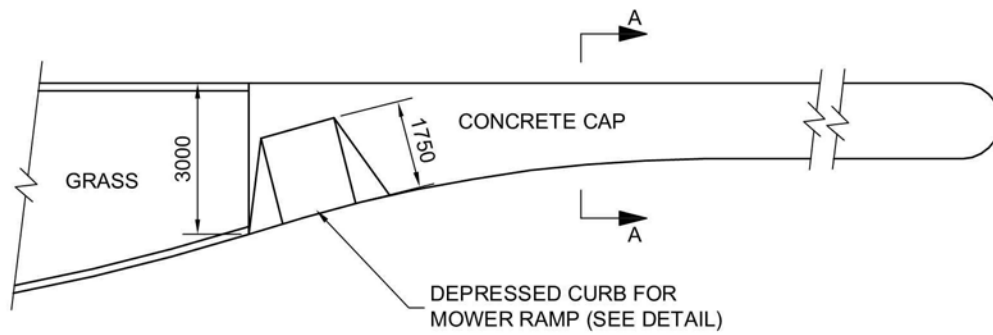
50.60.15

NO.	DATE	REVISION

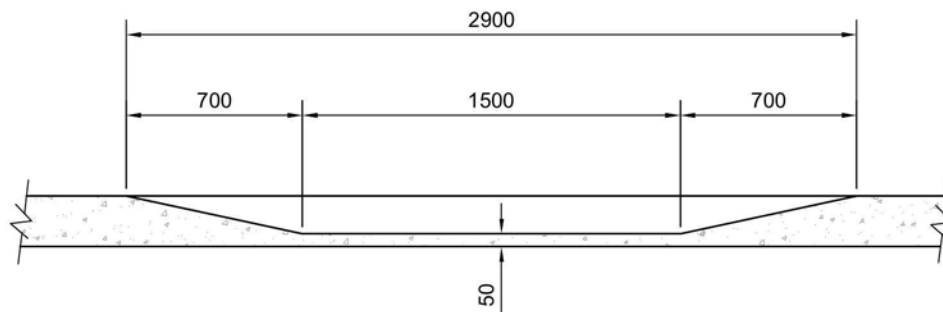


- CONCRETE THICKNESS TO BE 150mm FOR COMMERCIAL SIDEWALK CROSSING.
- 50mm MINIMUM CONCRETE COVER OVER OR UNDER REINFORCING.
- REINFORCEMENT FOR CURB FLAGGING TO BE 10M @ 500mm O.C. TYP. DOWELED 250mm INTO EXISTING SIDEWALK WITH 150mm CAST INTO NEW CURB.

			THE TOWN OF SYLVAN LAKE		
			DRAWN BY: D.K.	CONSTRUCTION SPECIFICATION DRAWINGS Concrete Work	APPROVED BY:  DIRECTOR OF PUBLIC WORKS
			DATE: JAN 2014	CONCRETE DOWELING DETAIL FOR SIDEWALK REPLACEMENT	DRAWING NO. 50.60.16
			SCALE: N.T.S.		
NO.	DATE	REVISION			



SECTION 'A - A'



DEPRESSED CURB - MOWER RAMP DETAIL

THE TOWN OF SYLVAN LAKE

DRAWN BY:
D.K.

DATE:
JAN 2014

SCALE:
N.T.S.

CONSTRUCTION SPECIFICATION DRAWINGS
Concrete Work

ARTERIAL ROADWAY MEDIAN

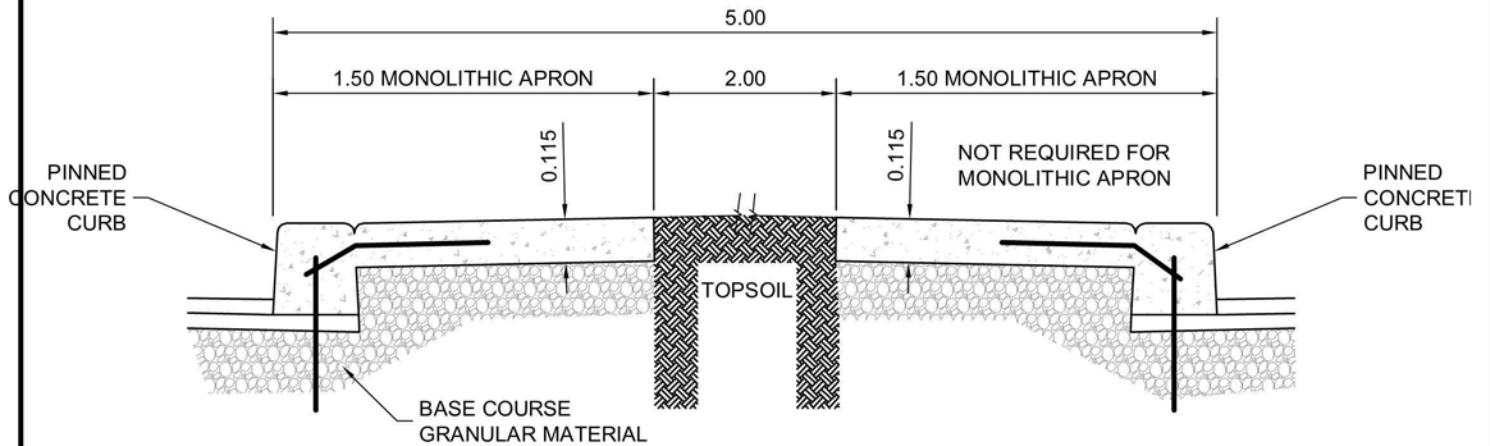
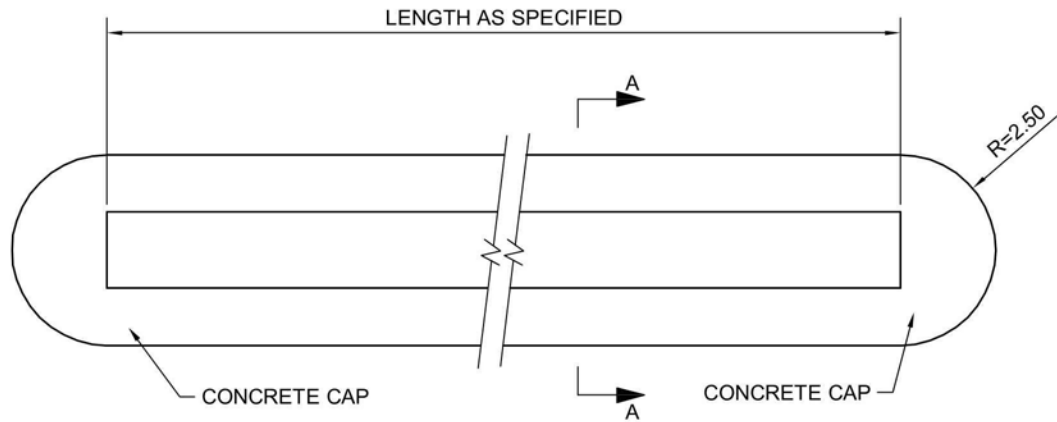
APPROVED BY:

A.G.
DIRECTOR OF
PUBLIC WORKS

DRAWING NO.

50.60.17

NO.	DATE	REVISION



NOTE :
PATTERNED MATERIAL FOR APRON IS PERMITTED

SECTION 'A - A'

THE TOWN OF SYLVAN LAKE

DRAWN BY:
D.K.

DATE:
JAN 2014

SCALE:
N.T.S.

CONSTRUCTION SPECIFICATION DRAWINGS
Concrete Work

COLLECTOR AND LOCAL
ROADWAY MEDIANS

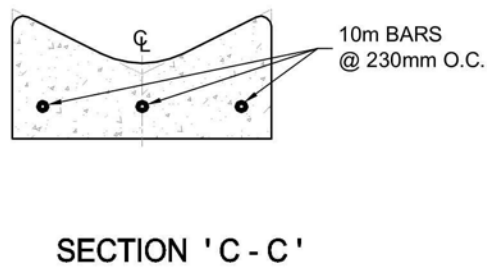
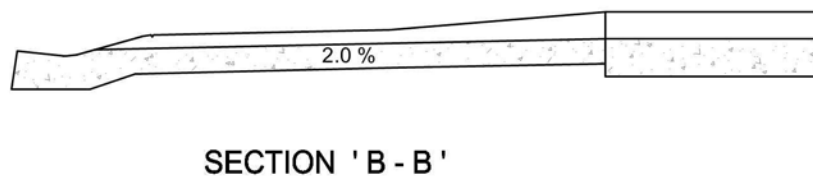
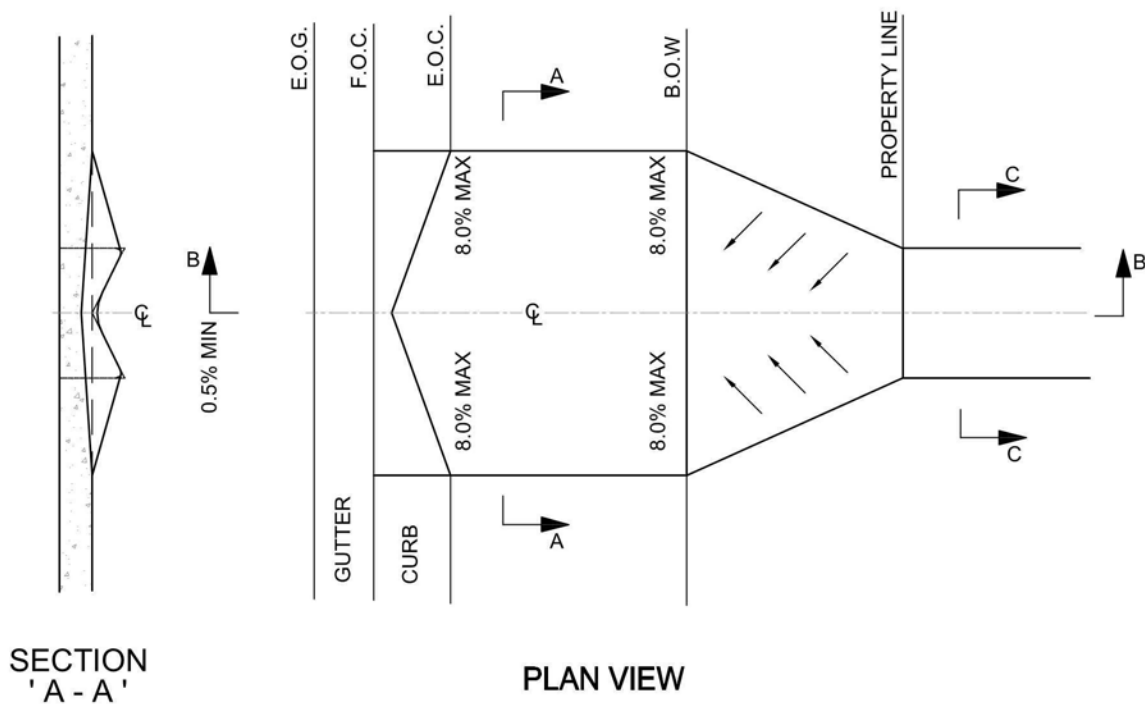
APPROVED BY:


A.G.
DIRECTOR OF
PUBLIC WORKS


DRAWING NO.

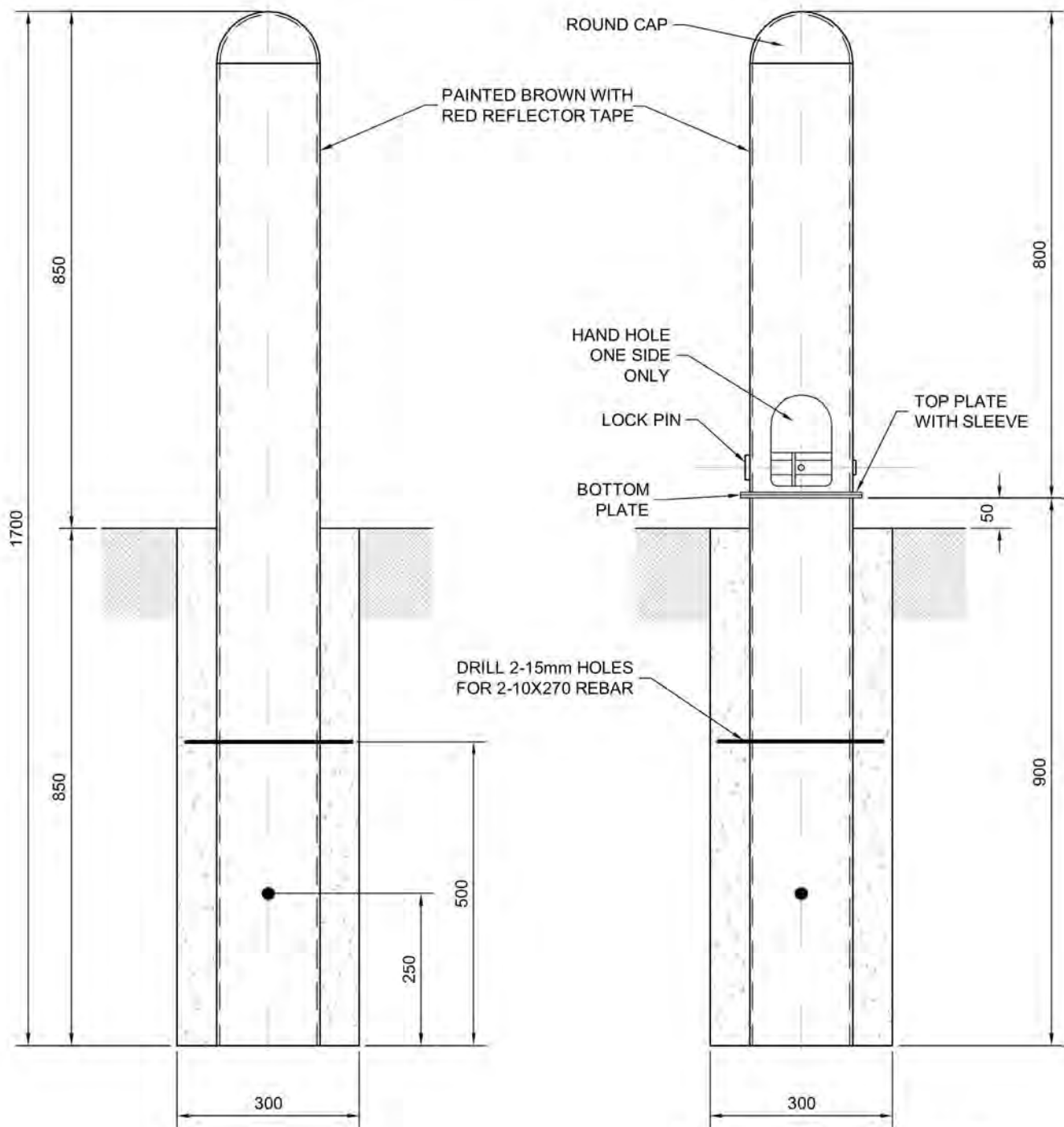
50.60.18

NO.	DATE	REVISION



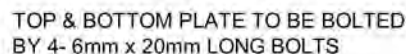
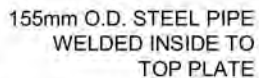
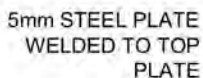
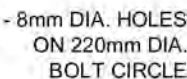
			THE TOWN OF SYLVAN LAKE		
			DRAWN BY: D.K.	CONSTRUCTION SPECIFICATION DRAWINGS Concrete Work	APPROVED BY:  DIRECTOR OF PUBLIC WORKS
			DATE: JAN 2014	DRAINAGE SWALE	DRAWING NO. 50.60.19
			SCALE: N.T.S.		
NO.	DATE	REVISION			


			THE TOWN OF SYLVAN LAKE		
			DRAWN BY: D.K.	CONSTRUCTION SPECIFICATION DRAWINGS Concrete Work	APPROVED BY:  DIRECTOR OF PUBLIC WORKS
			DATE: JAN 2014	DRAINAGE SWALE INTO BOULEVARD CATCH BASIN	DRAWING NO. 50.60.20
			SCALE: N.T.S.		
NO.	DATE	REVISION			



NOTE: CONCRETE TO HAVE 25mm AGGREGATE, MINIMUM 20 MPa

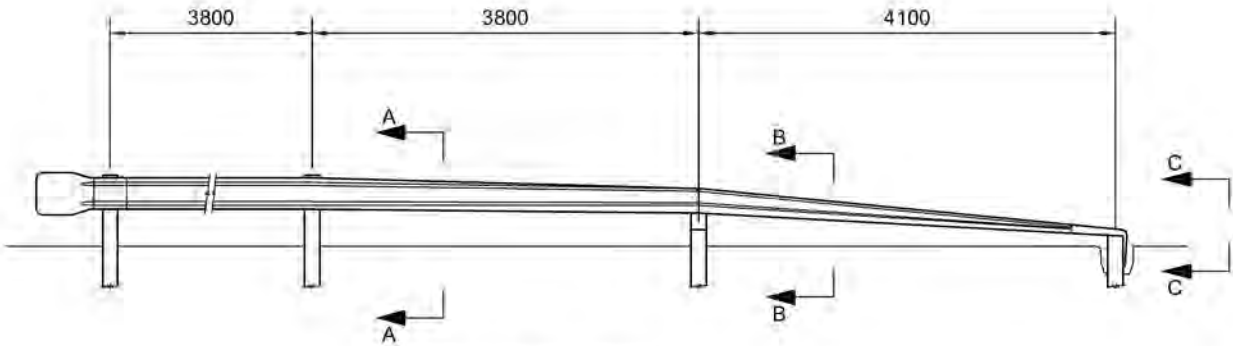
			THE TOWN OF SYLVAN LAKE		
			DRAWN BY: D.K.	CONSTRUCTION SPECIFICATION DRAWINGS Concrete Work	APPROVED BY: A.G. DIRECTOR OF PUBLIC WORKS
			DATE JAN 2014	BOLLARD ASSEMBLY	DRAWING NO. 50.70.01
			SCALE: N.T.S.		
NO.	DATE	REVISION			



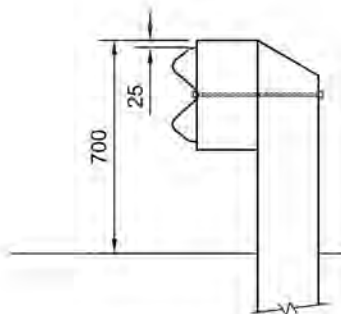
			THE TOWN OF SYLVAN LAKE		
			DRAWN BY: D.K.	CONSTRUCTION SPECIFICATION DRAWINGS Concrete Work	APPROVED BY:  DIRECTOR OF PUBLIC WORKS
			DATE: JAN 2014	KNOCKDOWN BOLLARD DETAIL	DRAWING NO. 50.70.02
			SCALE: N.T.S.		
REV	DATE	REVISION			



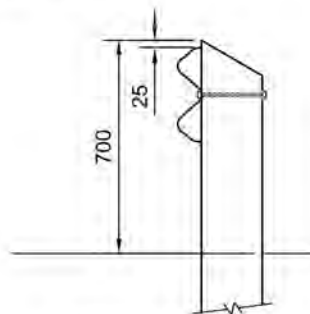
PLAN VIEW



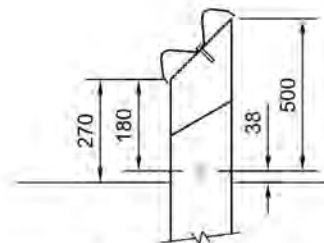
ELEVATION VIEW



WITH BLOCKING

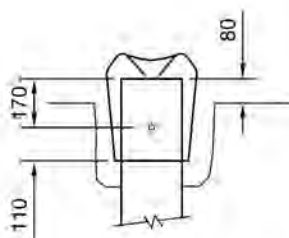


WITHOUT BLOCKING



SECTION 'B - B'

SECTION 'A - A'



SECTION 'C - C'

NOTES :

- GUARDRAIL MATERIAL TO BE ARMCO OR EQUAL.
- BOTH ENDS ARE TO BE TURNED DOWN FOR 2 - WAY TRAFFIC.
- OFFSET IS TO BE AS PER T.A.C. MANUAL.
- ALL POSTS ARE TREATED TIMBER 150mm X 200mm X 1300mm.
- USE 1910mm POST SPACING WHERE RIGIDITY IS REQUIRED TO REDUCE DEFLECTION.
- ALL BLOCKS ARE TREATED TIMBER 150mm X 200mm X 360mm.

THE TOWN OF SYLVAN LAKE

CONSTRUCTION SPECIFICATION DRAWINGS
Concrete Work

W-BEAM GAURDRAIL

APPROVED BY:

A.G.
DIRECTOR OF
PUBLIC WORKS

DRAWING NO.

50.70.03

DRAWN BY:

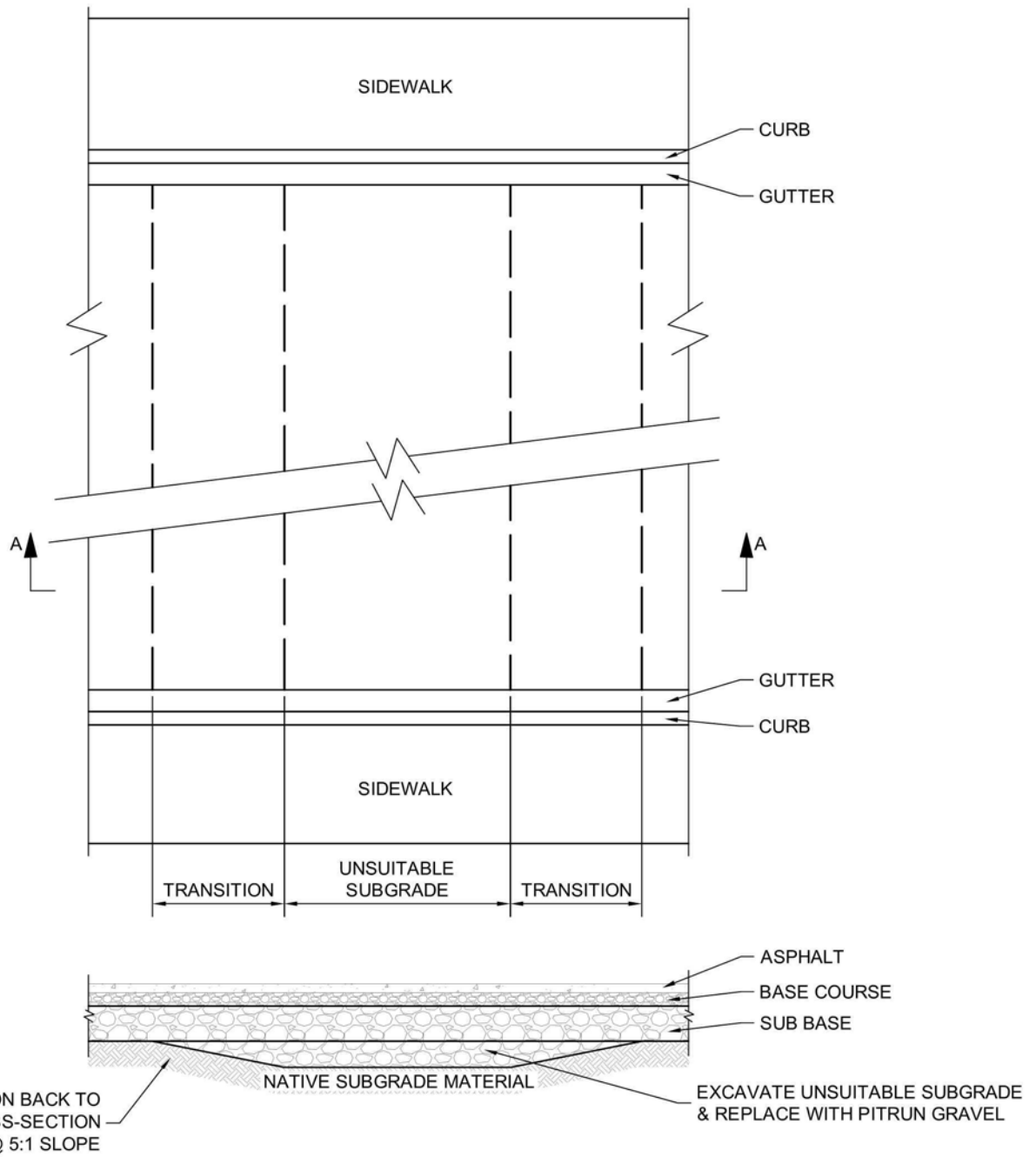
D.K.

DATE:

JAN 2014

SCALE:

N.T.S.



SECTION 'A - A'

- NOTE :
- EXCAVATE FROM LIP OF GUTTER TO LIP OF GUTTER IF UNSUITABLE SUBGRADE IS ENCOUNTERED.
 - VERTICAL CUT AT LIP OF GUTTER.

THE TOWN OF SYLVAN LAKE

DRAWN BY:
D.K.

CONSTRUCTION SPECIFICATION DRAWINGS
Concrete Work

APPROVED BY:

A.G.
DIRECTOR OF
PUBLIC WORKS

DATE:
JAN 2014

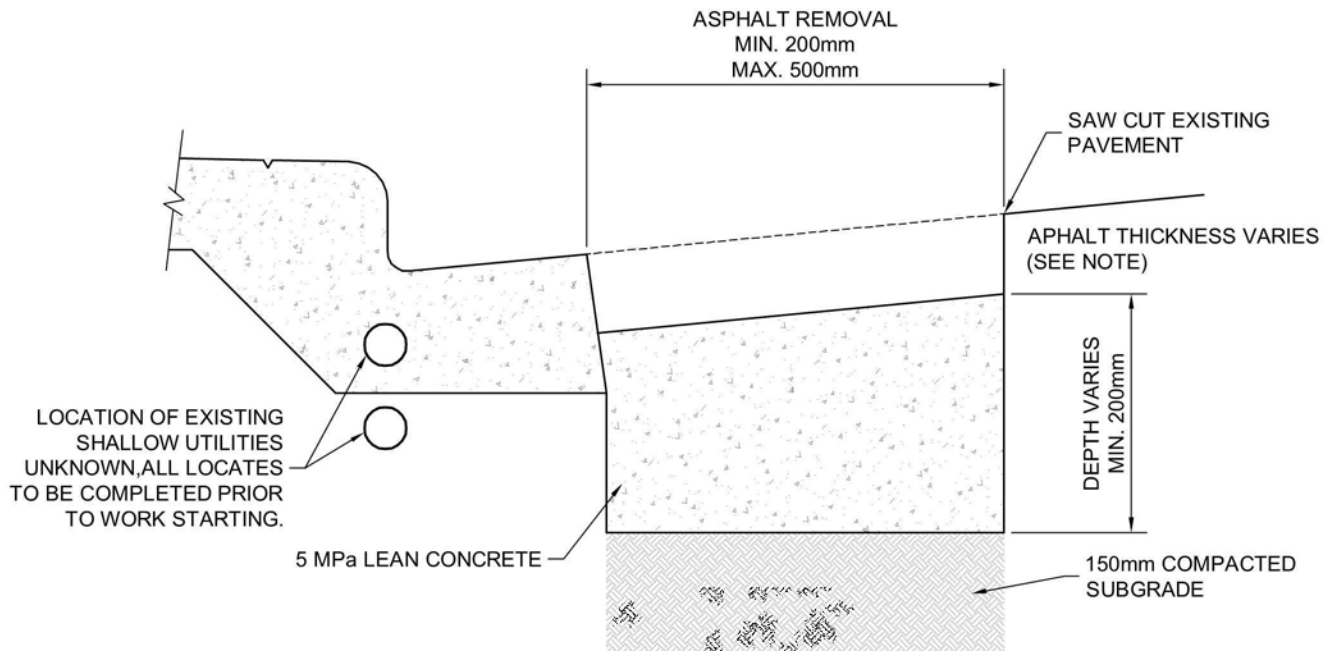
SCALE:
N.T.S.

W-BEAM GAURDRAIL

DRAWING NO.

50.70.03

NO.	DATE	REVISION



NOTE :

- REMOVE ASPHALT, BASE COURSE AND RE-COMPACT SUBGRADE.
- BACKFILL AREA BETWEEN LIP OF GUTTER AND EDGE OF ASPHALT WITH LEAN CONCRETE SLURRY MIX.
- PLACE SLURRY MIX TO MATCH UNDERSIDE OF THE EXISTING ASPHALT OR TO A MAXIMUM DEPTH OF 75mm BELOW THE LIP OF GUTTER.

THE TOWN OF SYLVAN LAKE

DRAWN BY:
D.K.

DATE:
JAN 2014

SCALE:
N.T.S.

CONSTRUCTION SPECIFICATION DRAWINGS
Concrete Work

PAVEMENT REMOVAL &
REPLACEMENT ADJACENT
TO A CURB

APPROVED BY:

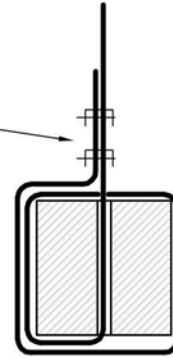
A.G.
DIRECTOR OF
PUBLIC WORKS

DRAWING NO.

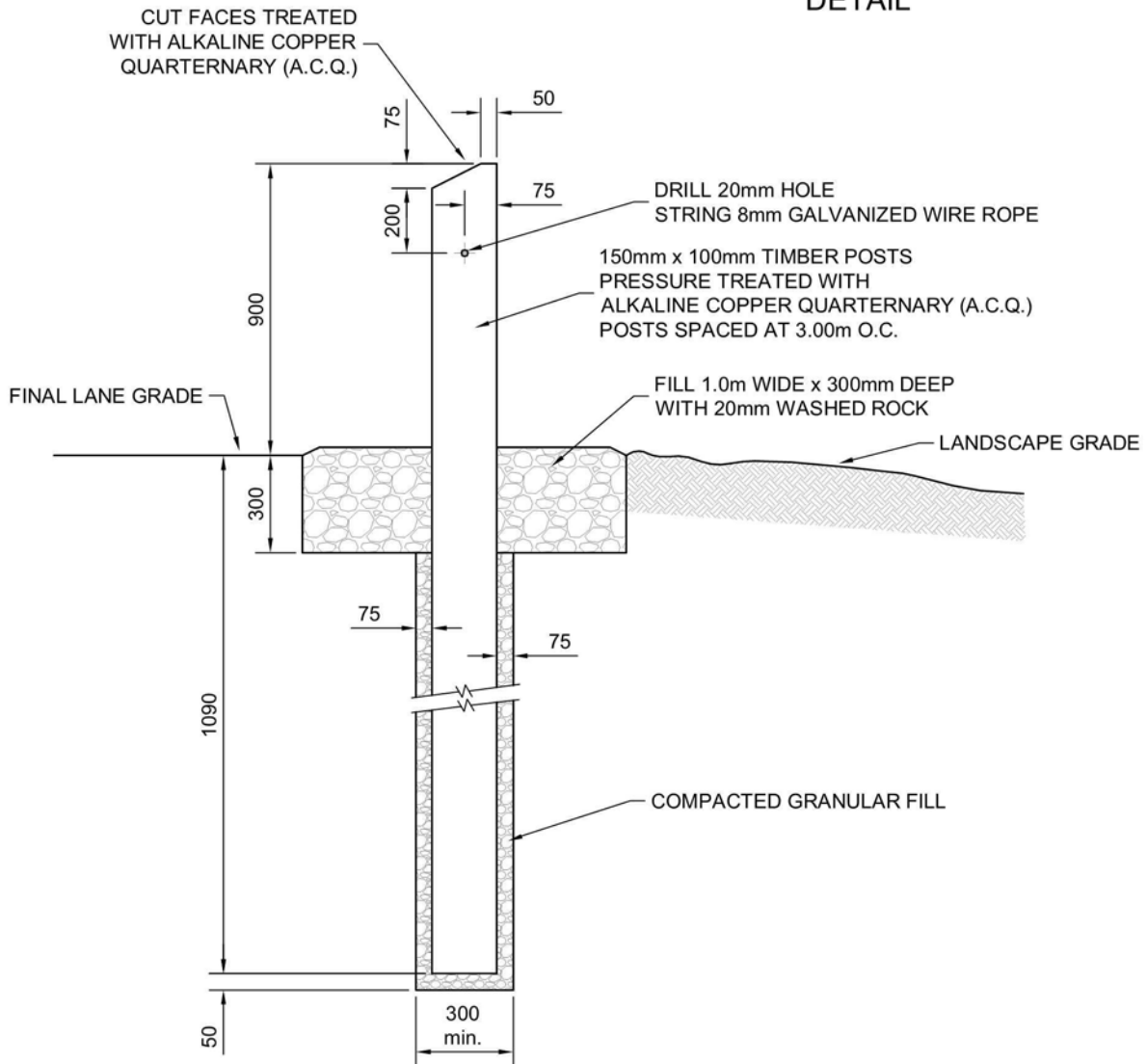
50.70.05

NO.	DATE	REVISION

8mm GALVANIZED WIRE ROPE
TO BE WRAPPED AROUND THE
POST ONE TIME & CLAMPED ON
THE INSIDE WITH 2 CABLE CLAMPS



CABLE TERMINATION DETAIL



THE TOWN OF SYLVAN LAKE

DRAWN BY:
D.K.

CONSTRUCTION SPECIFICATION DRAWINGS
Concrete Work

APPROVED BY:

A.G.
DIRECTOR OF
PUBLIC WORKS

DATE:
JAN 2014

POST AND CABLE FENCE

SCALE:
N.T.S.

DRAWING NO.

50.70.06

NO.	DATE	REVISION