Medicine Hat
The Gas City

MUNICIPAL WORKS CONSTRUCTION SPECIFICATIONS

April 2023

Permit to Practice

The APEGA Authenticating Professional Work Products practice standard requires the authentication and validation of any document containing technical information. The City of Medicine Hat MW-Construction Specifications have been revised to add authenticators and responsible members. Tables A and B list standard detail drawings along with their respective authenticators and responsible member. Sections 01500-07000 of the specification are not authenticated, but are only included for reference purposes. Authentication and validation will be required on a project-by-project basis for these sections, and project engineer will be responsible for conducting the authentication and validation process.

TABLE A

STANDARD DRAWINGS-ROADS

RD 200 - YIELDING BREAKAWAY SIGN POST ASSEMBLY

RD 201 - STEEL BEAM GUIDE RAIL - RAIL DETAILS

RD 202 - STEEL BEAM GUIDE RIAL - ASSMBLY DETAILS SINGLE RAIL

RD 203 - DEAD END BARRICADE

RD 204 - BOLLARD AND CHAIN

RD 205 - REMOVABLE STEEL BOLLARD DETAIL

RD 206 - WOOD BOLLARD DETAIL (FLAT TOP)

RD 207 - W-BEAM GUARDRAIL HARDWARE WOOD SPACER BLOCK
& POST STRONG POST SYSTEM

RD 300 - CURB & GUTTER SECTIONS

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RD 302 - MONOLITHIC SIDEWALK CURB & GUTTER

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RD 307 - DOUBLE CURB RAMP DESIGN SEPARATE SIDEWALK

RD 308 - DOUBLE CURB RAMP DESIGN MONOLITHIC SIDEWALK

RD 309 - LARGE SINGLE CURB RAMP DESIGN SEPARATE SIDEWALK

RD 310 - LARGE SINGLE CURB RAMP DESIGN MONOLITHIC SIDEWALK

RD 311 - ONE DIRECTION CURB RAMP DESIGN SEPARATE SIDEWALK

RD 312 - ONE DIRECTION CURB RAMP DESIGN MONOLITHIC SIDEWALK

RD 313 - MULTI - USE SIDEWALK

RD 314 - MULTI - USE SIDEWALK WITH SIDE AND BACK SLOPE

RD 315 - UTILITY TRENCH BACKFILL REQUIREMENTS

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TABLE B

STANDARD DRAWINGS-STORM DRAINAGE

ST 400 - CLASS “A” BEDDING

ST 401 - CLASS “B” BEDDING

ST 402 - TYPE K-1 CATCH BASIN & CATCH BASIN MANHOLE TOP SECTION

ST 403 - K1 CATCH BASIN FRAME

ST 404 - K1 CATCH BASIN GRATE

ST 405 - K1 CATCH BASIN SIDE INLET

ST 406 - K7 CATCH BASIN

ST 407 - K7 CATCH BASIN FRAME

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ST 409 - TWIN CATCH BASIN / CATCH BASIN MANHOLE ASSEMBLY

ST 410 - 1200mm TYPE 5A PRECAST MANHOLE ASSEMBLY

ST 411 - MANHOLE BASES, SLAB TOP & COCRETE ADJUSTER RINGS

ST 412 - TYPE 1S PRECAST MANHOLE ASSEMBLY

ST 413 - 1500 - 3000mm LARGE DIAMETER MANHOLE ASSEMBLY

ST 414 - MANHOLE SAFETY PLATFORM

ST 415 - MANICURED PARKS CATCH BASIN

ST 416 - F-49 STORM SEWER MANHOLE STEEL RISER FRAME RINGS

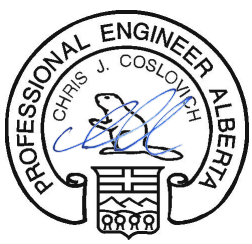
ST 417 - STANDARD F-49 MANHOLE FRAM AND COVER

ST 418 - F-68 OPEN GRATE MANHOLE FRAME AND COVER

ST 419 - INLET CONTROL DEVICE (ICD)

ST 420 - TYPICAL SUB-DRAIN SYSTEM INSTALLATION

ST 421 - UNIFORM BACKFILL SUB-DRAIN SYSTEM INSTALLATION

Authentication Stamp  April 5, 2023 ID 61352	Responsible Member Stan Nowakowski Validation Stamp  The City of Medicine Hat Permit #: P 4206

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SAFETY REQUIREMENTS

1. GENERAL

.1 The Contractor shall be responsible for the safety of all persons and property on or about the project and for ensuring that the Work is performed in accordance with all applicable safety requirements.

.2 The Contractor will obtain and review the most recent Temporary Traffic Control Manual, available on the City of Medicine Hat website.

.3 Without in any way limiting the generality of the foregoing, the Contractor shall comply fully with the following provisions.

2. NOTICE

.1 The Contractor shall provide at least seventy-two (72) hours' written notice to all utility companies and property owners in the immediate vicinity of his operations prior to the commencement of construction and shall, if requested, cooperate with such parties in the protection, removal or relocation of their installations and property.

.2 The contractor shall provide at least 48 hours notice to the following when construction limits the flow of traffic on existing roads:

.1	Fire Department	403-529-8481
.2	Police Department	403-529-8481
.3	Ambulance Service	403-529-8481
.4	Municipal Works	403-529-8177
.5	Utility Locates – (Alberta One Call)	1-800-242-3447
.6	Environmental Utilities	403-529-8171
.7	Shaw Cable	403-488-7429

.3 The Contractor shall provide at least 48 hours notice to the Fire Department and Environmental Utilities before interrupting the flow to hydrants.

.4 Locate all underground utilities prior to commencing excavation. Notify Project Engineer and Utility Departments 48 hours before excavating utility line locates. Protect active utility lines exposed by excavation from damage, as instructed by the Utility Department or Company. Final excavation in the area of any utility lines to be done by hand.

3. SAFETY PROGRAM

.1 The Contractor shall develop, maintain and supervise for the duration of the Work a comprehensive safety program that will effectively incorporate and implement all required safety precautions. The program shall, as a minimum, respond fully to the requirements of all applicable laws, ordinances, rules, regulations and orders and general construction practices for the safety of persons or property, including without limitation any general safety rules and regulations of the Owner and any Workers'

Compensation or Occupational Health and Safety legislation or regulations that may be applicable (ie. WHMIS).

.2 The Contractor shall provide two copies of the safety program to the Engineer for review and delivery to the Owner prior to the commencement of construction.

4. SAFETY OFFICER

.1 The Contractor shall designate a safety officer who shall be qualified and authorized to supervise and enforce compliance with the safety program.

5. SAFETY MEETINGS

.1 The Contractor shall arrange regular safety meetings at his expense. Such meetings shall occur no less frequently than once per week. The Contractor shall record the minutes of such meetings and maintain a complete file for review by the appropriate authorities.

6. SAFETY EQUIPMENT

.1 The Contractor shall supply and maintain, at his own expense, at his office or other well known place at the job site, safety equipment necessary to protect the workers and general public against accident or injury as prescribed by the governing authorities.

.2 Provide for the use of the Engineer safety equipment such as ropes, safety belts, combustible/hazardous gas and oxygen depletion protective equipment. Provide assistance as required to Engineer's staff when entry is required to manholes or other areas which may be hazardous.

7. FIRE PREVENTION AND PROTECTION

.1 The Contractor shall perform all Work in a fire-safe manner. He shall comply with all applicable governmental requirements and, without limiting the generality of the foregoing, shall supply and maintain at the job site adequate and appropriate fire-fighting equipment.

8. NIGHT WORK

.1 Night work will only be permitted by the Contractor if permission is given beforehand by the appropriate authorities and the engineer. When work is carried out at night, the Contractor shall supply a sufficient number of electric or other approved lights to enable the work to be done in a safe and satisfactory manner.

9. ACCIDENTS AND ACCIDENT REPORTS

.1 Except as otherwise agreed to in the Contract, the Contractor shall supply and maintain all articles necessary for giving first-aid to any person who may be injured on the job site and shall establish an emergency procedure for the immediate removal of any injured person to a hospital or a doctor's care in accordance with applicable legislative and regulatory requirements.

.2 The Contractor shall promptly report in writing to the appropriate authorities, the Owner and the Engineer all accidents of any sort arising out of or in conjunction with the performance of the Work whether on or adjacent to the job site, giving full details and statements of witnesses. If death or serious injuries or damages are caused, the accident shall be promptly reported by the Contractor to the Owner and the Engineer by telephone or messenger in addition to any reporting required under local laws and regulations.

.3 If a claim is made by anyone against the Contractor or any subcontractor on account of any accident, the Contractor shall promptly report the facts in writing to the Owner and the Engineer, giving full details of the claim.

10. GUARD RAILS AND BARRICADES

.1 Construct and maintain any guard rails, barricades, pedestrian access ways and safety protection devices required in connection with the Work at no cost the owner (considered incidental to the work).

11. OCCUPATIONAL HEALTH & SAFETY ACT

.1 The Contractor shall be the Prime Contractor for the Project pursuant to the applicable legislation and shall have primary responsibility for the safety of all workers and equipment on the Project in accordance with such legislation.

END OF SECTION

TEMPORARY FENCING

1. GENERAL

1.1 Description

.1 This section specifies requirements for temporary security fencing around excavation areas, working areas, environmental reserve areas, and protected areas.

.2 Locate all underground utilities prior to commencing excavation. Notify Project Engineer and Utility Departments 48 hours before excavating utility line locates. Protect active utility lines exposed by excavation from damage, as instructed by the Utility Department or Company. Final excavation in the area of any utility lines to be done by hand.

.3 Obtain approval of the Project Engineer and all affected utilities, prior to commencing excavation.

1.2 Temporary Fencing

.1 Temporary fencing around excavations shall be polyethylene safety fence.

.2 Temporary fencing around environmental reserve and protected areas shall be coloured flagging or appropriate ribbon as approved by the Engineer.

.3 The Contractor shall install fence posts at safe distances from existing utilities or as directed by the Utility Owner.

2. PRODUCTS

2.1 Materials

.1 Fabric Type (Polyethylene Safety Fence)

.1 High density polyethylene fencing material with; 33 mm x 33 mm square or diamond shaped mesh, minimum height of 1200 mm, orange colour. Tensar Safety Grid-GS as manufactured by Nilex Inc. or approved alternate.

.2 Posts

.1 Studded Steel T-Posts

.1 Minimum length - 900 mm longer than the fabric width.

.2 Portable Posts

.1 The Contractor shall submit details for approval.

.3 Gates

.1 The Contractor shall submit details for approval for gates for access to working area.

.4 Flagging/Ribbons

.1 Fluorescent orange or yellow as approved by the Engineer.

3. EXECUTION

3.1 Grading

.1 Remove debris and grade between posts to provide ground clearance between 40 mm and 100 mm.

3.2 Post Spacing

.1 Space T-posts at 3.0 m centre to centre. If portable posts are used, reduce spacing to suit.

3.3 Post Setting – T-Posts

.1 Drive T-posts into the ground, at specified spacing.

.2 Set posts in line and plumb so that the fence forms a straight line between corner posts.

.3 Install straining posts where required.

3.4 Fabric Installation

.1 Set braces for gates and corners.

.2 Install fabric in accordance with the manufacturer’s instructions.

.3 Fasten fabric to posts and bracing wire with nylon ties.

.4 Stretch fabric and secure using steel bars in accordance with the manufacturer's instructions.

3.5 Flagging/Ribbon Installation

.1 Attach ribbon to trees around environmental reserve and protected areas.

3.6 Clean-up

.1 Clean up debris and trim all areas disturbed.

END OF SECTION

CLEARING AND GRUBBING

1. GENERAL

1.1 Definitions

.1 Clearing:

.1 Clearing shall consist of cutting, piling, removal and disposing of trees, brush vegetative growth and logs above the ground surface.

.2 Grubbing:

.1 Grubbing shall consist of removal and disposing of all objectionable material below the ground surface including roots, brush, stumps and buried debris.

1.2 Regulatory Requirements

.1 The Contractor shall obtain necessary permits from authorities having jurisdiction and adhere to Provincial and Local bylaws regarding disposal of merchantable timber in the area (burning of disposal material will not be allowed with-in the City of Medicine Hat Corporate limits).

1.3 Protection

.1 Prevent damage to fencing, trees, landscaping, natural features, bench marks, existing buildings, utility lines, site appurtenances, water courses and root systems of trees which are to remain. All damage incurred shall be repaired by the Contractor at his expense.

.2 Apply tree paint approved by the Engineer, to cuts or scars suffered by vegetation designated to remain.

1.4 Products

.1 The Contractor is to supply all labour, materials and equipment required for clearing and grubbing.

2. EXECUTION

2.1 Clearing

.1 Cut, remove, and dispose of all timber, brush, windfall and any other fallen timber, stumps and rubbish except such trees and shrubs as may be designated for preservation by the Engineer.

.2 Preserve such designated trees and shrubs from scarring, barking or other injury during construction operations.

.3 Where no grubbing is to be done, all trees, roots and existing stumps shall be cut off flush with the original ground surface.

.4 Cut, remove and dispose of dangerous trees overhanging off the right-of-way.

.5 Pull down, remove and dispose of structures, fences and any physical obstructions.

2.2 Grubbing

.1 Excavate, remove and dispose of all roots, stumps, submerged logs, corduroy and similar objectionable matter, to a minimum depth of 0.2 m.

.2 Fill holes and level areas disturbed by grubbing.

2.3 Disposal

.1 All cleared and grubbed materials shall be removed from the designated work areas and shall be disposed of in a manner satisfactory to the Engineer and the appropriate governmental authority, and shall be disposed of as soon as possible after the initial removal. In no case shall it be left to interfere with grading operations.

.2 Burning of cleared and grubbed materials will not be allowed with-in the City of Medicine Hat Corporate Limits.

2.4 Finish

.1 Leave the ground surface in a condition suitable for stripping of topsoil.

END OF SECTION

W-BEAM GUIDERAIL

1. GENERAL

1.1 Description

.1 This section specifies requirements for the supply and installation of W-Beam Guiderail.

2. MATERIALS

2.1 Rails and Terminal Elements

.1 Guiderail shall consist of rail sections fabricated for installation to develop continuous beam strength with the necessary safety and feature components.

.2 All rail sections and other components shall match the design profiles and dimensions of the AASHTO hardware requirements for full interchangeability of similar components, regardless of the source of manufacturer.

.3 The rails and terminal elements shall be manufactured from sheet steel and hot dip galvanized after fabrication, all in accordance with the AASHTO standard M180-841 and shall conform to the Contract drawing.

.4 Rails shall be punched for splice and post bolts in conformity with the AASHTO standard to the designated number of and center-to-center spacing of posts. Punching, cutting, burning or welding will not be permitted on site except for special details, as directed by the Engineer.

.5 The rails and terminal elements shall be manufactured according to the following standards:

.1 Metal Properties: Properties of the base metal for the rails shall conform to the following requirements:

.1 Gauge – 12 minimum

.2 Minimum Yield Point – 345 MPa

.3 Minimum Tensile Strength – 550 MPa

.4 Minimum Elongation – Min. 12% in 50 mm length

.2 Sheet Thickness: The rails and terminal elements thickness shall be manufactured according to Table 1 (Class A, Type 2) of AASHTO standard M180-841 with no nominal base metal thickness of 2.8 mm (2.67 mm min.).

.3 Sheet Width: Sheet width for the rail shall be 483 mm with a permissible tolerance of minus 3 mm.

.6 The load shall be applied through a 75 mm flat surface at the centre of a freely supported 3.65 m clear span and when the joint is tested it shall be at the centre of the span.

Maximum Deflection	Load Traffic Face Up	Load Traffic Face Down
70 mm	680 Kg.	550 Kg.
140 mm	900 Kg.	1,180 Kg.

.7 All rails and terminal elements shall be hot dip galvanized after fabrication, conforming to CSA-G164M.

.8 All welding required for special detail fabrications shall conform to the requirements of CSA-W59M. Only welders, welding operators and tackers approved by the Canadian Welding Bureau in the particular category may be permitted to perform weldments.

.9 A copy of the manufacturer's certificate, conforming to Section 16 of CAN/CSA G40.20M, for each of the mechanical and chemical test, including impact tests, shall be provided to the Engineer upon request.

2.2 Bolts, Nuts and Washers

.1 All bolts, nuts and washers shall conform to ASTM-A307 and shall be hot dip galvanized, conforming to CSA-G164M. The post connection shall withstand a 2,250 Kg. side pull in either direction.

2.3 Guiderail Materials

.1 The size and thickness of rails and terminal elements shall be within the following tolerances:

1. Base Metal Thickness: 2.8 mm nominal

.2 Galvanized Finished Thickness: 2.82 mm

.3 Tolerance: 0.23 mm

.2 Hot dip galvanized coating shall be smooth, free of beading or sharp projections at edges. Coating adherence shall prevent the peeling of any portion of the zinc coating so as to expose the base metal by cutting or prying with a stout knife under considerable pressure (bond check). Magnetic gauge may be used for thickness verification in accordance with ASTM Standard E316 (c).

.3 Warped or otherwise deformed rails and terminal elements will be rejected as will those with injurious defects or excessive roughness of the zinc coating. When the rail is laid on a flat surface, the warpage shall not be greater the 5 cm.

2.4 Posts and Blocks

.1 The wood posts and blocks shall be constructed with pine; and conform to No. 1 Structural Grade for posts and timbers as classified and defined by NLGA 1970 Standard Grading Rules for Canadian Lumber.

.2 All posts and blocks shall be incised and pressure treated with Chromate Copper Arsenate (CCA) to a minimum net retention of 6.4 Kg/m^3 of wood (3.5 Kg/m^3 for blocks), in accordance with CSA Standard 080.14: Pressure Preserved Wood for Highway Construction.

2.5 Backfill

.1 Materials excavated for guiderail post installations may be used as backfill. The Engineer shall inspect excavated materials for suitability as backfill. All backfill must be completed to meet a minimum 95% of Standard Proctor maximum dry density within +/- 2% of optimum moisture.

3. EXECUTION

3.1 Installation

.1 The guiderail shall be accurately set to the required depth and alignment, in a manner resulting in a smooth continuous installation, as shown on the drawings or as directed by the Engineer. Permissible tolerance for plumb and grade of posts shall be 6 mm maximum.

.2 The guiderail laps shall be in the direction of traffic flow. Bolts shall be tightened to a torque of 100 N-m (75 ft.-lb.). Reflector strips, 50 mm x 300 mm shall be supplied and attached to the tops of posts as per drawings with a sufficient number of 50 mm aluminium nails.

.3 The Contractor shall take all necessary precautions to eliminate damage to galvanizing. Painting with two (2) coats of zinc rich paint shall repair minor abrasions. The method to be used for repair of any damage shall be approved by the Engineer before such work is commenced. The Contractor shall repair or replace components to the satisfaction of the Engineer.

.4 All installed guiderail posts shall be backfilled in accordance with Clause 2.5.1 of this Section.

.5 Posts shall be spaced on 1.8m centres (minimum) measured along the centreline of the beam unless otherwise directed by the Engineer. In the vicinity of structures spacing can be closer as shown on the Standard Drawings for post installation. The beams are erected to produce a smooth continuous rail paralleling the line and grade of the highway surface or as shown on the plans. .

.6 The horizontal centreline of the guiderail shall be installed 610 mm (2’-0”) above the existing grade line unless otherwise directed by; the Engineer.

.7 Surplus excavated materials and debris shall be removed from the site for proper disposal.

4. INSPECTIONS OF MATERIALS

.1 All guiderail materials shall be inspected and materials that fail to meet these specifications will be rejected, and shall be replaced or repaired at the Contractors expense.

END OF SECTION

BOLLARD AND CHAIN FENCING

1. GENERAL

1. The Contractor is responsible to have all underground utilities located. Contact the utility companies of City Departments a minimum of 48 hours in advance (see Section 01500 – Safety Requirements, Section 2).

.2 The Project Engineer will mark the alignment for the installation of the bollards. The Contractor shall contact the Project Engineer to request the marking of the alignment, 48 hours prior to calling for locates.

2. MATERIALS

.1 Bollards - 150 mm (6 inches) diameter rough sawn S.P.F. pressure treated (or equivalent) flat top posts, 1500 mm (60 inches) in length. Refer to Standard Drawings, DWG. No. MW 311 for visual representation.

.2 Chain – 7 mm (1/4inch) link zinc, grade 30.

.3 Removable Steel Bollard - Bollard base is 115 mm (4.5 inches) diameter schedule 40 pipe, 300 mm in length set in 300 mm (12 inches) concrete base. Concrete base is set flush with asphalt surface and open at bottom for drainage. Refer to Standard Drawings, DWG. No. MW 310 for visual representation.

.4 Concrete Base – See Section 05210 for concrete specifications.

3. INSTALLATION

.1 The bollards shall be installed on the City side of the property line.

.2 In locations where bollard and chain is to be installed, the bollards shall be installed on 2.4 m (8 ft) centre.

.3 In locations where bollards only are to be installed, the bollards shall be installed on 1.5 m (5 ft) centre.

.4 Bollards shall be installed level and in alignment with the property line. Install bollards in the ground with 750 mm (29.5 inches) exposed above the ground. All holes shall be tamped to ensure bollards are installed tight. The Contractor is responsible for re-drilling any holes.

.5 Install 3.0 m (10 ft) chain gate where directed by the Engineer. The City shall supply the padlock.

.6 Drill a hole in the bollard 35 mm (1 3/8 inches) in diameter 100 mm (4inches) from the top of the bollard.

.7 Install the chain through the holes in each bollard.

.8 Using 150mm (6 inches) galvanized nails, anchor the chain in each post.

.9 Chain between posts shall have approximately 100 mm to 150mm (4 to 6 inches) of sway.

.10 Install removable steel bollard 600 mm (23.5 inches) above ground. Bollard base pipe set in concrete. Concrete base to be flush with asphalt surface.

.11 Refer to Standard Drawings, DWG. No. MW 204 for installation of Bollard and Chain.

.12 Refer to Standard Drawings, DWG. No. MW 310 for installation of Removable Steel Bollard.

.13 Refer to Standard Drawings, DWG. No. MW 311 for installation of Wood Bollard.

4. SITE CLEAN UP

.1 The Contractor shall take every precaution not to damage, injure or mark existing surfaces, structures or landscaping on the City owned property or adjacent private properties.

.2 Any damage that may be caused by the Contractor, his employees or equipment or subcontractors, shall be restored to pre-construction condition at the Contractor's expense and to the satisfaction of the Project Manager.

.3 All areas disturbed as a result of construction shall be reseeded as per the seeding specifications.

5. INSPECTION

.1 Upon completion of bollard installation, the contractor shall arrange for inspection.

END OF SECTION

BARBED WIRE FENCING

1. GENERAL

1.1 Requirements

.1 To supply all plant, labour, materials and equipment for construction of barb wire fence, supports and gates, and the construction and removal of temporary fences during construction.

2. PRODUCTS

2.1 Posts

.1 Line posts shall be pressure preservative treated in 2.1 metre lengths and shall be 125mm nominal round diameter. Posts shall be new, straight, free from large cracks and set a minimum of 0.75 metres into the ground.

.2 Corner, end, and pull posts shall be pressure preservative treated in 2.44 metre lengths and shall be 150mm nominal round diameter. Posts shall be new, straight, free from large cracks, and set a minimum of 1.05 metres into the ground.

.3 Brace posts shall be pressure preservative treated in 3.05 metre lengths and shall be 100mm nominal round diameter. Posts shall be new, straight, and free from large cracks.

2.2 Wire and Hardware

.1 Barbed wire shall be composed of two main strands of 12 gauge galvanized steel having a minimum breaking strength of 1930 kg. Four point barbs shall be spaced 127 mm apart.

.2 Smooth wire for braces shall be galvanized 9 gauge steel wire having a minimum tensile strength of 3169 kg/cm^2.

.3 Staples shall be 9 gauge galvanized steel measuring 38mm long.

.4 Tension springs shall be approved fence tension springs typically used in fence construction.

3. ASSEMBLIES

3.1 General

.1 Diagonal wood braces shall be attached with 9.5mm x 102mm steel dowel at each end extending 50mm into the brace and 50mm into the post, 75mm above grade and 25mm below the top of the adjacent post.

.2 Wire braces shall be comprised of four strands of 9 gauge steel wire securely fastened 150mm below the top of the post and 100mm above grade. The wire shall be tightened (twisted) with a 19mm x 25mm wood lab or 100mm diameter steel rod until the entire assemble is rigid. Slats or rods shall be left in position.

.3 Horizontal brace shall be cut to length and placed 300mm below the top of the posts. The brace is to be installed level with 9.5mm x 102mm steel dowel at each end, extending 50mm into the post.

3.2 End Assembly

.1 The end assembly shall consist of one (1) end post and two (2) pull posts, two (2) brace posts and two (2) wire brace assemblies.

.2 The end post shall be placed at the location required for termination of a fence assembly.

.3 The first pull post shall be placed 2.51 metres for the end post in line with the fence assembly. The second pull post shall be placed 2.51 metres from the first pull post in line with the fence assembly.

.4 Two (2) diagonal wood braces shall be attached with 9.5mm x 102mm steel dowel at each end extending 50mm into the brace and 50mm into the post, 10 cm above grade and 250mm below the top of the adjacent post.

.5 Wire braces shall be installed as specified in 3.1.2 above.

3.3 Corner Assembly

.1 Corner assemblies are constructed as tow end assemblies with at shared end post.

3.4 Fence Assembly

.1 The fences assembly shall consist of line posts spaced approximately 5.0 m apart and placed a minimum of 750mm into the ground.

.2 Four strands of barbed wire shall be strung, stretched and stapled such that Run 1 is 300mm above grade and follows general ground contour and Runs 2, 3, and 4 spaced in 300mm intervals above Run 1.

.3 The wire shall be wrapped around end posts stapled and tied.

.4 The fence shall be straight. The top of the fence shall follow the contour of the land in a smooth fashion.

.5 The Contractor is responsible for staking of post locations. Reference points, if required, will be provided by the Engineer.

.6 Posts installed in pre-drilled holes shall be aligned and thoroughly hand tamped for the entire backfill.

.7 Posts installed by post-pounder method may require trimming to remove damaged post tops. Posts requiring more than 150 mm of trimming shall be removed and replaced.

3.5 Pull Post Assembly

.1 Pull post assembly shall be spaced at 200 m maximum intervals or at points of fence direction change.

.2 The centre post of the assembly is specified as an end or corner post with two side posts specified as pull posts.

.3 Two (2) horizontal braces shall be placed between the pull posts and the centre post and fastened as described in Section 3.1.2 above.

.4 Four (4) smooth wire braces shall be placed as in Section 3.1.2 above to form an X in both spans.

3.6 Gate Assembly

.1 The gate assembly shall consist of two (2) end assemblies and a wire/post gate.

.2 The wire post gate shall consist of four (4) brace posts, as described in Section 2.1.3 cut to 1.37 m in length and spaced 2.51 m apart. The closing post of the gate shall be in a line post and cut to 1.37 m long.

.3 A Gen Manufacturing Ltd. Of Coaldale, Alberta, 6HD Easy-Lock Gate Closer, or approved equal, shall be supplied and installed as per manufacturer's instructions.

.4 Gate wire shall be supplied and installed as per Section 3.4.2 fastened to an end post with tension springs wrapped and tied around the closing post.

3.7 Installation

.1 The fence shall be installed at locations specified on the Drawings.

.2 One barbed wire shall be first stretched at the bottom to determine alignment of line posts and shall be temporarily fastened to end posts. This barbed wire may be left at the bottom when needed.

.3 End (or corner) post assemblies- the fence or stretchers shall be attached to the first brace post in the assembly. Its design provides for maximum strain taken at the point. A slack span of fence fabric is used between the end (or corner) post and the first brace post after stretching is completed.

.4 Pull-post assembly – the fence fabric shall be extended past the first post and attached to the middle post. The wires shall be cut and wrapped around the post.

.5 The tension for stretching the woven-wire fence shall be applied at two points on the clamp bar by using stretchers designed and manufactured for that purpose. Stretchers shall be so designed that tension can be applied to both ends of the bar at the same time. All splices in the fabric shall be securely made, with a Western Union splice or commercial splicing device approved by the Engineer.

.6 The tension for stretching the barbed wire shall be applied by use of single-wire stretchers designed and manufactured for that purpose, and in accordance with the wire manufacturer's recommendations. Barbed wire shall be fastened to all posts with staples. The staples shall be driven at an angle to the grain and with points slightly downward.

.7 The fence fabric shall be on the side of the post where the livestock may be kept.

3.8 Temporary Fence

.1 When requested by the Engineer, the contractor shall supply and install temporary fence to keep livestock out of the construction area. The contractor may use materials salvaged during fence removal. Post spacing and number of wires shall be sufficient to contain livestock during construction period. After the new permanent fence has been installed, the temporary shall be co-ordinated with the landowner.

END OF SECTION

CULVERTS

1. GENERAL

1.1 Description

.1 This section specifies requirements for the supply and installation of culverts.

2. PRODUCTS

2.1 Corrugated Steel Pipe

.1 Culverts shall be corrugated steel pipe, manufactured in accordance with CAN/CSA -G401 and shall be zinc coated by a hot-dip galvanizing process in accordance with CAN/CSA-G164M.

.2 The wall thickness shall be 1.6 mm in the 300 mm, 400 mm, 500 mm and 600 mm sizes, and 2.0 mm in the 700 mm, 800 mm and 900 mm culvert sizes, and the corrugation pattern shall be 68 mm pitch and 13 mm depth.

.3 The pipe sections shall be connected with corrugated band couplings, also conforming to CAN3-G401. Ends shall be cut square or bevelled as indicated.

2.2 Culvert Granular Bedding

.1 Granular bedding materials shall be in accordance with Section 05020 Clause 2.2.3 Granular Base/Sub-Base Preparation.

.2 The granular bedding material shall be supplied by the Contractor and shall be subject to the approval of the Engineer prior to being placed in the work.

2.3 Culvert Backfill

.1 Materials for culvert backfill shall be a mixture of the excavated material obtained from the excavations on the road alignments.

.2 Use of random culvert backfill shall be subject to the approval of the Engineer.

3. EXECUTION

3.1 Trenching and Excavation

.1 The excavation for the culvert base shall be carried to a depth of not less than 150 mm below the invert grade, as established by the Engineer and shall be of sufficient width to permit pipe assembly and to accommodate operation of compaction equipment on either side of the culvert.

.2 The excavation side slopes shall be excavated to a 6:1 slope.

3.2 Culvert Bedding

.1 Place minimum 150 mm thick layer of compacted granular material on bottom of excavation. Place material in uniform layers not exceeding 150 mm thickness, and compact each layer with mechanical compaction equipment.

.2 Any soft and yielding or other unsuitable material below this level shall be removed to the depth directed by the Engineer and backfilled with the approved granular material.

.3 Granular material shall be compacted to density not less than 98% of Standard Proctor Density in accordance with ASTM D698 (Method C or D). Granular materials shall be moisture conditioned by drying or by adding water, to obtain in-place moisture content between optimum and minus two percent of the specified optimum moisture content.

.4 The base for culverts installed along main water courses or through yielding areas shall consist of gravel bedding compacted to the excavated depth and extending over a width of three (3) times the diameter of the pipe. The depth of this base shall be not less than 300 mm. An impervious compacted bedding material shall be provided for a minimum length of 3 m or three (3) times the diameter of the pipe, whichever is greater, at the inlet end and outlet end of the culvert to achieve a seal against seepage. Rip rap placement at each end to be directed by Engineer.

.5 Trench line and grade requires the Engineer's approval prior to placing bedding material or pipe.

.6 Do not backfill until pipe grade and alignment are checked and accepted by the Engineer.

3.3 Laying Corrugated Steel Pipe Culverts

.1 Commence pipe placing at downstream end on the prepared granular bedding with separated sections securely joined together by means of a coupling band.

.2 Do not allow water to flow through pipes during construction except as permitted by the Engineer.

.3 All culverts shall be laid so that the horizontal seams fall at the sides of the culverts.

.4 The pipe shall be laid true to line and grade as established by the Engineer and the pipe shall be carefully handled to prevent damage to the galvanized coating. Damaged pipe sections shall be immediately reported to the Engineer and repaired and replaced according to their direction.

.5 Centreline of culvert shall not vary from the designated horizontal alignment by more than 75 mm. Invert grade shall not vary from the designated invert grade elevation by more than 12 mm provided positive flow is maintained.

3.4 Culvert Backfill

.1 After assembly of the culvert on the bedding, the culvert shall be backfilled with the specified granular and approved random backfill. Backfill shall be brought up on both sides of the culvert simultaneously. Culvert backfill materials shall be compacted to density not less than 98% of Standard Proctor Maximum Dry Density in accordance with ASTM D698 (Method C or D). Backfill materials shall be moisture conditioned by drying or by adding water, to obtain in-place moisture content between plus /minus two percent (± 2%) of the specified optimum moisture content.

.2 The backfill shall be spread and compacted in 150 mm layers and special care shall be taken to ensure proper filling and compacting under the haunches and within the culvert corrugations.

.3 Heavy equipment shall not be allowed over the culvert until a minimum of 0.6 m of fill is obtained above the crown of the pipe.

END OF SECTION

CHAIN LINK FENCE AND GATES

1. GENERAL

1.1 Requirements

.1 The Work covered by this section consists of supplying all labour, plant, materials, tools and equipment necessary and required to complete all chain link fence and gates as shown on the Drawings and/or specified herein.

2. PRODUCTS

2.1 Materials

.1 The Contractor shall supply galvanized metal chain link fences as manufactured by Frost Steel Wire Co. Ltd. or approved equal. All fencing materials shall be new.

.2 The fences shall be 1280 mm high to the top rail.

.3 Fabric:

.1 Chain line fence fabric shall be 1220 mm high, woven of 4 mm wire in a 50 mm diamond-mesh pattern, hot dipped galvanized after weaving in accordance with CAN/CGSB-138.1, Grade 2.

.2 The top selvage shall be a twisted and barbed finish and the bottom selvage shall be a knuckled finish.

.3 Galvanized fabric shall have an average of 488 grams per square meter of zinc coating.

.4 Line Posts:

.1 Line posts shall be 60 mm outside diameter, Standard Continuous Weld Schedule 40 pipe, galvanized with a minimum weight of 5.4 kilograms per linear meter.

.2 No tubing, conduit or open seam material will be permitted. Line posts shall be spaced as shown on the Drawings and in no case further than 3000 mm apart.

.5 Terminal Posts:

.1 End, corner, gate and straining posts shall be 90 mm outside diameter Standard Continuous Weld Schedule 40 pipe, galvanized with a minimum weight of 11.2 kilograms per linear meter.

.2 No tubing, conduit or open seam material will be permitted.

.6 Post Tops:

.1 Post tops shall be pressed steel, or aluminium designed as a weather-tight closure cap for tubular posts.

.2 One cap for each post shall be provided.

.3 Where top rail is used, tops which permit passage of top rail shall be provided.

.7 Tension Wire:

.1 Tension wire shall be zinc or aluminium coated coil spring steel wire not less than 5 mm in diameter.

.2 Tie clips of manufacturer's standard as approved for attaching the wire to the fabric, at intervals not exceeding 500 mm shall be provided.

.8 Tension Bars:

.1 Tension bars shall be one-piece lengths equal to full height of fabric with a minimum cross-section of 4.75 mm by 19 mm.

.2 One stretcher bar for each gate and end post and two for each corner and pull post shall be provided.

.9 Tension Bar Bands:

.1 Tension bar bands shall be heavy pressed steel, spaced not over 380 mm on centre to secure stretcher bars to tubular end, corner, pull and gate posts.

.10 Top Rail:

.1 Top rail shall be 43 mm outside diameter galvanized pipe, plain ends, random lengths, Standard Continuous Weld Schedule 40 pipe or high strength hollow structural section 2.5 mm wall with mechanical properties similar to ASTM Specification A.36.

.2 No tubing, conduit or open seam material will be permitted.

.3 Couplings shall be outside sleeve type and at least 150 mm long. Springs at one coupling in five to permit expansion in rail as recommended by the manufacturer shall be provided.

.4 Top rail shall extend through line post tops to form continuous brace from end-to-end of each stretch of fence.

.11 Braces:

.1 Braces shall be of the same material as the top rail and shall be installed midway between the top rail and extend from the terminal post to the first adjacent line post.

.2 Braces shall be securely fastened to the posts by heavy pressed steel and malleable fittings, then securely trussed from line post to base of terminal post with a 10 mm truss rod and tightener.

.12 Fittings:

.1 Fittings shall be malleable steel, cast iron, or pressed steel, as required.

.2 Fittings to include extension arms for barbed wire, stretcher bars and clamps, clips, tension rods, brace rods, hardware, fabric bands and fastenings, and all accessories.

.3 Forty-five degree angle bracket type supports to accommodate three strands of barbed wire as shown shall be provided.

.13 Gates:

.1 Gates shall be swing type, complete with latches, stops, keepers and hinges. Gate frames shall be of the same material as the top rail.

.2 Frames are to be electrically welded at all joints and galvanized after welding.

.3 Gates shall be supplied with galvanized malleable iron hinges, latch and latch catch.

.14 Adhesive Anchors:

.1 Supply adhesive anchors for posts located on concrete structures.

.2 Adhesive anchors to be HIT-HY 150 MAX system as manufactured by Hilti Ltd. or FLO-ROK Injection Anchoring System as manufactured by Ucan Fastening Products Ltd.

.3 Provide galvanized threaded rods, nuts and washers.

3. EXECUTION

3.1 General

.1 Install fencing and gates as required and in accordance with CAN/CGSB-138.3.

.2 Fencing shall be erected in straight lines between angle points by skilled personnel experienced in this type of construction. The fences shall be erected in accordance with the manufacturer's recommendations as approved and with these Specifications. The posts shall be set plumb and in true in line. Top rail of the fence shall be at the top of the fabric.

.3 Chain link fabric shall be fastened to end posts with stretch bars and clamps and to line posts and top rail with wire or bands at approximately 350 mm centres and too mm centres, respectively.

.4 Gate posts shall be braced as specified.

.5 Gates shall be hung and all hardware adjusted so that gates operate satisfactorily from open or closed position.

.6 Fence posts shall be welded to metal base plates, as shown on the Drawings.

.7 All fastenings required to attach base plates securely to the top or vertical face of the concrete are to be supplied by the Contractor.

.8 Space line posts 3 m apart measured parallel to the ground or concrete surface.

.9 Space straining posts at equal intervals not exceeding 15 m if distance between end or corner posts on straight continuous lengths of fence over reasonably smooth grade is greater than 150 m.

.10 Install additional straining posts at greater than 10 degree changes in direction.

.11 Install corner post where change in alignment exceeds 10 degrees.

.12 Install end posts at end of fence. Install gate posts on both sides of gate openings.

.13. Do not install chain link fence fabric until concrete has cured a minimum of 7 days at ambient temperatures above 10ºC.

.14 Install brace between end and gate posts and nearest line post, placed in centre of panel and parallel to ground surface. Install braces on both sides of corner and straining posts in similar manner.

.15 Install top rail between posts and fasten securely to posts and secure waterproof caps and overhang tops.

.16 Install bottom tension wire, stretch tightly and fasten securely to end, corner, gate and straining posts with turnbuckles and tension bar bands.

.17 Lay out fence fabric. Stretch tightly to tension recommended by the 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 selvedge at bottom. Twisted selvedge at top.

.18 Secure fabric to top rails, line posts and bottom tension wire with tie wires at 450 mm intervals. Give tie wires minimum two twists.

.19 Install adhesive anchors in accordance with the manufacturer's written instructions. Drill holes to the required diameter and embedment depth and cleaned out with a wire brush or compressed are free of oil. Cure time for the adhesive to be as specified by the manufacturer.

3.2 Installation of Gates

.1 Install gates in locations shown on the Drawings.

.2 Level ground between gate posts and set gate bottom 50 mm above the ground surface.

.3 Determine position of centre gate rest for the double gate. Cast gate rest in concrete as shown on the Drawings and extend concrete 50 mm above ground level and slope to drain away from the gate rest.

.4 Install gate stops where indicated on the Drawings.

3.3 Repair of Damaged Galvanized Coatings

.1 Repair damaged galvanized surfaces using a zinc rich paint conforming to MIL SPEC DOD-P-21035.

END OF SECTION

PAVEMENT MARKINGS GENERAL

1. GENERAL

1.1 Description

.1 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.

.2 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).

1.2 Related Work

.1	Painted Pavement Markings	Section 02571
.2	Thermoplastic Pavement Markings	Section 02572
.3	Spray Pavement Markings	Section 02573
.4	Cold Plastic Markings	Section 02574
.5	Pavement Marking Removal	Section 02577
.6	Pavement Surface Cleaning	Section 02800

1.3 References

.1 ASTM D4060: Test Method for Abrasion Resistance of Organic Coating by the Taber Abraser.

.2 ASTM D256: Standard Test Method for Determining the Izod Pendulum Impact Resistance of Plastics.

.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: Standard Test Method for Color and Color-Difference Measurement by Tristmulus Colorimetry.

.6 City of Medicine Hat Temporary Traffic Control Manual (2008)

.7 ASTM D1214: Standard Test Method for Sieve Analysis of Glass Spheres.

1.4 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 Marking materials shall be a formulation, identified by a manufacturer's code number, prequalified by and have the same composition as the prequalified marking material. Acceptance criteria for new plastic pavement marking materials are included in Clause 2.2 of this Section.

.2 When plastic pavement markings are to be installed, the Contractor and Subcontractor (applicator) shall provide written evidence that he has a minimum of three (3) years successful experience supplying and installing plastic pavement markings, as specified in Section 02572 Thermoplastic Pavement Markings, Section 02573 Spray Pavement Markings, and Section 02574 Cold Plastic Markings, and also be acceptable to the City of Medicine Hat.

.3 Pavement marking materials shall conform to the following Specification Sections:

.1	Painted Pavement Markings	Section 02571
.2	Thermoplastic Pavement Markings	Section 02572
.3	Spray Plastic Pavement Markings	Section 02573
.4	Cold Plastic Pavement Markings	Section 02574

.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. The applicator shall maintain current material safety data sheets for all materials present with this work in an immediately accessible location.

.5 Glass beads: Overlay type: to CGSB 1-GP-74M as follows:

.1 Imperfections: surface of spheres shall be smooth and free from film, scratches and pits. At least 90% shall be true spherical shape, and free from milkiness, dark or air inclusions and other defects.

.2 Index of refraction: liquid immersion method at 25º 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 the following gradation requirements when tested in accordance with ASTM D1214.

.1 Spheres included in manufacture of thermoplastic material:

Sieve Size (Microns)	% Passing
250	80 – 100
100	0 - 10

.2 Spheres for application on molten thermoplastic material:

Sieve Size (Microns)	% Passing
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.

2.2 Criteria for Acceptance

.1 Plastic pavement marking materials shall be acceptable for installation on City of Medicine Hat roadways based on the following criteria:

.1 The Contractor/Supplier has installed that particular product in other cities with similar climatic conditions as Medicine Hat.

.2 The material was installed on roadways with more than 10,000 vehicles per day and have met warranty conditions set out in this section (see 4.3.2).

.3 The Contractor has provided three (3) references for the product's past performance.

.2 The Contractor shall submit the requested information for the City of Medicine Hat's assessment of a product at least three (3) months prior to bidding on any roadway project in the City.

.3 Plastic pavement marking material that does not meet the above noted criteria may be considered for installation at locations specified by the City of Medicine Hat 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 General

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

.2 Lines shall be applied as solid, dashed or dotted stripes, either singly or in combination, as shown on the Drawings. 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. 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.

.3 Gaps not marked as a result of template use for symbols and words shall be filled with marking material after template removal.

.4 Pavement markings shall be free of uneven edges, overspray or other readily visible defects that detract from the appearance or function of the pavement markings.

.5 Methods and equipment used for pavement preparation, marking and marking removal shall be subject to the approval of the Engineer. Glass beads shall be kept dry during storage and prior to use.

.6 The Contractor shall furnish to the Engineer copies of the current manufacturer's instructions and recommendations for application of any marking material, including primer, activator, catalyst and/or adhesive called for in the plans.

.7 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 markings.

3.2 Storage

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

3.3 Site Preparation

.1 Maintain vehicular and pedestrian traffic in accordance with Section 01500 and as directed by the Engineer. Provide flagmen, barricades, flares and signing to protect the workers and public.

.2 Sweep or air blow pavement surface clean and dry to Section 02800 Pavement Surface Cleaning.

.3 If required, remove existing marking and repair pavement surface in accordance with Section 02577 Pavement Marking Removal.

.4 Pre-mark intended lines at a minimum off-set of 150 mm or as directed by Engineer. Pre-mark outline of symbols. The Engineer shall inspect and approve pre-marking. Any correction to the pre-marking shall be a the Contractor's expense. All markings shall be within 12 mm ± of that specified on the drawings, unless the Engineer approves the variances.

3.4 Line Application

.1 Lines shall be sharp, well defined and uniformly retroflective. The width of the line applied shall be the width specified. Fuzzy lines, excessive overspray or non-uniform application are unacceptable. Lines shall provide proper visibility.

.2 Pavement markings that are improperly applied, located or reflectorized shall be corrected. Lines applied with insufficient material quantities shall be properly reapplied.

.3 Improperly located lines shall be removed in accordance with Section 02577 Pavement Marking Removal at the contractor's expense, including furnishing of approved materials.

3.5 Line Dimensions and Acceptable Pavement Marking Materials

.1 Line dimensions shall be as follows:

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
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 line; 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

3.6 Installation

.1 Paint application: as specified in Section 02571 Painted Pavement Markings.

.2 Hot thermoplastic application: as specified in Section 02572 Thermoplastic Pavement Markings.

.3 Spray plastic application: as specified in Section 02573 Spray Plastic Pavement Markings.

.4 Cold plastic application: as specified in Section 02574 Cold Plastic Pavement Markings.

3.7 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 damage as directed by the Engineer.

.3 On completion of the Work clean up and leave the site free of debris and waste matter.

3.8 Workmanship

.1 Faulty markings, such as non-straight lines, non-uniform, excessive overflow, overspray, etc., shall be redone within five (5) working days at the expense of the Contractor.

4.0 PERFORMANCE LIFE/ACCEPTANCE

4.1 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.

4.2 Initial Acceptance of Plastic Pavement Markings

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

.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 markings 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.

4.3 Final Acceptance/Warranty Period

.1 The warranty for the plastic pavement marking material shall be subject to traffic and normal summer and winter roadway maintenance procedures.

.2 During the warranty period, the Contractor, at no additional cost to the City, 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 (based on warranty):

.1 Two Year Warranty Products:

.1 Year One: 90%

.2 Year Two: 80%

.2 Three Year Warranty Products:

.1 Year One: 95%

.2 Year Two: 90%

.3 Year Three: 85%

.3 Five Year Warranty Products:

.1 Year One: 100%

.2 Year Two: 95%

.3 Year Three: 90%

.4 Year Four: 85%

.5 Year Five: 80%

END OF SECTION

PAINTED PAVEMENT MARKINGS

1. GENERAL

.1 This section specifies requirements for the supply and installation of painted pavement markings and painted pavement lines.

1.1 Related Work

.1	Pavement Markings General	Section 02570
.2	Pavement Marking Removal	Section 02577

2. PRODUCTS

2.1. Painted Markings

.1 To CGSB 1-GP74M, alkyd traffic paint meeting current Transportation Association of Canada and Environment Canada Regulations.

.2 Colour: to CGSB 1-GP-12C, yellow 505-308, white 513-301.

.3 Thinner: CAN/CGSB-1.5.

.4 Glass beads: Clause 2.1.5 of Section 02570 Pavement Markings General.

.5 Acceptable Products: See clause 2.2 of Section 02570 Pavement Markings General.

3. EXECUTION

3.1 Equipment

.1 Paint applicator shall be a approved pressure type 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 Paint applicator shall be capable of adjusting the paint application for the length of dashed line required. Each spray gun shall have independent controls and adjustment mechanisms and shall be operated from the operator's compartment.

.3 Bead dispensers shall be electrically controlled, air operated, gravity fed with controls to adjust the bead flow. The bead dispensers shall be fed from tanks capable of holding a minimum of 45 kilograms of beads.

.4 The painting truck shall be equipped with a television vehicle guidance or a vehicle guidance system mounted on a retractable A-frame with a guide wheel and pointer system, to assist the truck driver in maintaining alignment on the existing lines.

.5 The painting truck shall be equipped with an overhead revolving beacon with an amber lens a minimum of 180 mm high and 180 mm wide. The beacon shall be mounted on the top of the vehicle fully visible to traffic approaching from both front and rear.

.6 A “slow moving vehicle” and “wet paint keep off” sign shall be mounted at the rear of the vehicle and be visible to the public only when the painting truck is applying paint.

3.2 Preparation of Surface Conditions

.1 Pavement surface to be dry, free from ponded water, frost, ice, dust, oil, grease and other foreign materials. Sweeping or air blowing when required shall be completed by the Contractor.

.2 Remove conflicting existing markings and lines and repair surface in accordance with Section 02577 Pavement Marking Removal.

3.3 Traffic Control

.1 Conduct all traffic control in accordance with the current City of Medicine Hat Temporary Traffic Control Manual.

3.4 Paint and Bead Application

.1 Lay out pavement markings and line locations and review with Engineer.

.2 Apply painted markings and painted lines only when air temperature is above 10°C, wind speed is less than 60 km/h and no rain is forecast within next 6 hours.

.3 Apply traffic paint evenly at rate of 3.3 l/m^2. The first application of paint to new asphalt pavement surfaces shall be increased by 25% over the specified rate or as directed by Engineer.

.4 Do not thin paint unless approved by Engineer.

.5 Paint lines and markings to be of uniform colour and density with sharp edges.

.6 Glass beads shall be applied immediately following the paint application at a uniform application rate of 600g/l of paint. 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.

3.5 Protection and Cleanup

.1 Provide traffic control measures with adequate warning signs and traffic channelization devices to prevent tracking by vehicles.

.2 Do not permit traffic over applied painted markings and lines until they have adequately dried.

.3 On completion of work, clean up and leave site free of debris and waste matter.

.4 Repair any damage as directed by the Engineer.

4. TOLERANCES

4.1 Painted Markings and Lines

.1 Painted pavement markings and lines shall be within plus or minus 12 mm of dimensions indicated in the contract documents.

.2 Deficient pavement markings and lines shall be removed and replaced at the Contractors expense to the satisfaction of the Engineer. The method and equipment used by the Contractor to remove incorrectly painted markings and lines will be subject to the approval of the Engineer.

END OF SECTION

THERMOPLASTIC PAVEMENT MARKINGS

1. GENERAL

1.1 Description

.1 This section specifies requirements for supply and installation of hot thermoplastic markings on pavement.

1.2 Related Work

.1	Pavement Markings General	Section 02570
.2	Pavement Marking Removal	Section 02577
.3	Pavement Surface Cleaning	Section 02800

1.3 Plastic Pavement Marking Subcontractor Qualifications

.1 As specified in Section 02570 Pavement Markings General

2. PRODUCTS

2.1 Materials

.1 Thermoplastic pavement marking: hot-extruded, having a specific gravity of 2.0 minimum at 25º C, having a softening point of 90º 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 25º 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 D256 Method C.

.3 Abrasion Resistance: Maximum weight loss of 0.6 grams when subjected to 200 revolutions on a Taber Abrader at 25º C using H-22 Calibrade 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, and transmission fluid.

.5 Reheating: The thermoplastic compound shall maintain proper performance properties when heated 4 times to the application temperature. After heating to 800º 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 materials.

.9 Safety: In the plastic state, the material shall not give off fumes that are toxic or otherwise injurious to persons or property.

.10 Acceptable Products: See Clause 2.2, Section 02570 Pavement Markings General.

.2 Glass Beads to Section 02570 Pavement Markings General.

.3 Pre-marking Paint as approved by the Engineer.

.4 Groove Filler to Section 02800 Pavement Surface Cleaning.

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 0,45º 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 0,45º 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 Pavement marking materials shall be stored as per manufacturer's instructions.

3.2 Site Preparation

.1 Maintain vehicular and pedestrian traffic in accordance with Section 01500 Safety Requirements and as directed by the Engineer. Provide flagmen, barricades, flares, and signage to protect the workers and public.

.2 Sweep or air blow pavement surface clean and dry to Section 02800 Pavement Surface Cleaning.

.3 Pre-mark intended lines as specified in Section 02570 Pavement Markings General.

.4 Cut grooves in asphalt to designated width, length and depth as follows.

.1 Width and Length (Size): As specified in Section 02570 Pavement Markings General.

.2 Depth as follows:

.1 Lane and center Lines: 5 mm.

.2 Stop Lines, Crosswalk Lines, Guide Lines and Symbols: 10 mm

.3 Remove grindings and haul to designated disposal location. Sweep or air blast grooves 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, if applicable, 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 hardened state.

3.4 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 damage as directed by the Engineer.

.3 On completion of work clean up and leave the site free of debris and waste matter.

3.5 Workmanship

.1 As specified in Section 02570 Pavement Markings General.

3.6 Warranty

.1 Initial acceptance and warranty requirements for pavement markings are specified in Section 02570 Pavement Markings General.

END OF SECTION

SPRAY PLASTIC PAVEMENT MARKINGS

1. GENERAL

1.1 Description

.1 This section specifies requirements for supply and installation of Spray Plastic Markings on pavement.

1.2 Related Work

.1	Pavement Markings General	Section 02570
.2	Pavement Marking Removal	Section 02577
.3	Pavement Surface Cleaning	Section 02800

1.3 Plastic Pavement Marking Subcontractor Qualifications

.1 As specified in Section 02570 Pavement Marking General

2. PRODUCTS

2.1 Materials

.1 Spray plastic pavement markings: hybridized polymer epoxy spray type pavement marking material or alternate epoxy material, having a specific gravity of 1.27 minimum at 25º C, and conforming to the following:

.1 Water Absorption: 0.2% maximum by mass retained water after 24-hour immersion, according to ASTM D-570 Procedure A.

.2 Spray plastic material shall not be softened by heat after final cure.

.3 Abrasion Resistance:

.1 Maximum weight loss of 0.15 grams when subjected to 200 revolutions on a Taber Abrader at 25º C using H-22 Calibrade wheels weighted to 500 grams with test sample kept wet during test with distilled water in accordance with ASTM D4060, or

.2 Maximum weight loss of 90 grams when subjected to 1000 revolutions on a Taber Abrader at 25º C using CS-17 Calibrade wheels weighted to 1000 grams with test sample kept wet during test with distilled water in accordance with ASTM C501.

.3 Prepare test sample with representative material placed on a 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, and transmission fluid.

.5 No deterioration when in direct contact with asphalt cement in asphaltic concrete materials, or with sodium chloride, calcium chloride or other de-icing chemicals.

.6 Non-toxic and not harmful to persons or property when in hardened state.

.7 No discoloration from sunlight, ultraviolet exposure and no bond failure for the warranted life of the materials.

.8 Safety: In the plastic state, the material shall not give off fumes that are toxic or otherwise injurious to persons or property.

.9 Acceptable Products: See clause 2.2, Section 02570 Pavement Markings General.

.2 Glass Beads to Section 02570 Pavement Markings General.

.3 Pre-marking Paint as approved by the Engineer.

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 0,45º 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 0,45º 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.

3. EXECUTION

3.1 Storage

.1 Pavement marking materials shall be stored as per manufacturer's instructions.

3.2 Site Preparation

.1 Maintain vehicular and pedestrian traffic as directed by the Engineer. Provide flagmen, barricades, flares, and signage to protect the workers and public.

.2 Sweep or air blow pavement surface clean and dry to Section 02800 Pavement Surface Cleaning.

.3 If required, remove existing markings or conflicting marking and repair pavement surfaces as specified in Section 02577 Pavement Marking Removal.

.4 Pre-mark intended lines as specified in Section 02570 Pavement Markings General.

3.3 Installation

.1 Mix and apply by extrusion Spray Plastic markings according to manufacturer's instructions and procedures.

.2 Minimum thickness:

.1 .3 mm above pavement surface for hybridized polymer epoxy.

.2 .8mm TO 1.2 mm for MMA Spray Plastic.

.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 hardened state.

3.4 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 damage as directed by the Engineer.

.3 On completion of work clean up and leave the site free of debris and waste matter.

3.5 Workmanship

.1 As specified in Section 02570 Pavement Markings General.

3.6 Warranty

.1 Initial acceptance and warranty requirements for pavement markings are specified in Section 02570 Pavement Markings General.

END OF SECTION

COLD PLASTIC PAVEMENT MARKINGS

1. GENERAL

1.1 Description

.1 This section specifies requirements for supply and installation of MMA Cold Plastic Markings on pavement.

1.2 Related Work

.1	Pavement Markings General	Section 02570
.2	Pavement Marking Removal	Section 02577
.3	Pavement Surface Cleaning	Section 02800

1.3 Plastic Pavement Marking Subcontractor Qualifications

.1 As specified in Section 02570 Pavement Marking General

2. PRODUCTS

2.1 Materials

.1 Cold plastic pavement markings: two component, cold extruded and cold curing pavement marking material, having a specific gravity of 1.9 at 25º C, 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:

.1 Minimum 1.13 J at 25º C when material is cast into a bare 25 mm² cross-section by 75 mm long, with 25 mm extended above vice jaws in a catilever beam (Izod type) tester using the 2.82 J scale, according to ASTM D-256 Method C.

.3 Abrasion Resistance:

.1 Maximum weight loss of 0.6 grams when subjected to 200 revolutions on a Taber Abrader at 25º C using H-22 Calibrade wheels weighted to 500 grams with test sample kept wet during test with distilled water. Prepare test sample with representative material placed on a 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, and transmission fluid.

.5 No deterioration when in direct contact with asphalt cement in asphaltic concrete materials, or with sodium chloride, calcium chloride or other de-icing chemicals.

.6 Non-toxic and not harmful to persons or property when in hardened state.

.7 No discoloration from sunlight, ultraviolet exposure and no bond failure for the warranted life of the materials.

.8 Safety: In the plastic state, the material shall not give off fumes that are toxic or otherwise injurious to persons or property.

.9 Acceptable Products: See clause 2.2, Section 02570 Pavement Markings General.

.2 Glass Beads to Section 02570 Pavement Markings General.

.3 Pre-marking Paint as approved by the Engineer.

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 0,45º 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 0,45º 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.

3. EXECUTION

3.1 Storage

.1 Pavement marking materials shall be stored as per manufacturer's instructions.

3.2 Site Preparation

.1 Maintain vehicular and pedestrian traffic as directed by the Engineer. Provide flagmen, barricades, flares, and signage to protect the workers and public.

.2 Sweep or air blow pavement surface clean and dry to Section 02800 Pavement Surface Cleaning.

.3 If required, remove existing markings or conflicting marking and repair pavement surfaces as specified in Section 02577 Pavement Marking Removal.

.4 Pre-mark intended lines as specified in Section 02570 Pavement Markings General.

3.3 Installation

.1 Mix and apply by extrusion Cold Plastic markings according to manufacturer's instructions and procedures.

.2 Thickness: minimum thickness of 2.0 mm and a maximum thickness of 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 hardened state.

3.4 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 damage as directed by the Engineer.

.3 On completion of work clean up and leave the site free of debris and waste matter.

3.5 Workmanship

.1 As specified in Section 02570 Pavement Markings General.

3.6 Warranty

.1 Initial acceptance and warranty requirements for pavement markings are specified in Section 02570 Pavement Markings General.

END OF SECTION

PAVEMENT MARKING REMOVAL

1. GENERAL

1.1 Description

.1 This section specifies requirements for pavement marking removals.

1.2 Related Work

.1	Pavement Markings General	Section 02570
.2	Painted Pavement Markings	Section 02571
.3	Thermoplastic Pavement Markings	Section 02572
.4	Spray Plastic Pavement Markings	Section 02573
.5	Cold Plastic Pavement Markings	Section 02574
.6	Prime, Tack and Fog Coats	Section 05110
.7	Asphalt Concrete	Section 05140

2. PRODUCTS

2.1 Materials

.1 Abrasives used for removal of painted pavement markings to be products specially designed for sand blasting.

.2 Type M1 Asphalt Concrete Pavement to Section 05140 Asphalt Concrete.

.3 Tack coat to Section 05110 Prime, Tack and Fog Coats.

3. EXECUTION

3.1 Removals

.1 In areas designated:

.1 Thermoplastic in-laid lines by grinding out marking material and underlying asphalt to the width and length of the lines to a depth of 25 mm below the adjacent pavement surface or as directed by Engineer.

.2 Spray type and cold plastic lines and symbols by grinding off marking material. Do not damage underlying asphalt.

.3 Paint markings by sand blasting, do not damage underlying asphalt.

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

.3 Heater milling equipment not to be used.

.4 All residue from operations to be removed from site and disposed of by 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 are to be filled using Type M1 asphaltic concrete pavement to Section 05140 Asphalt Concrete. Apply tack coat prior to placing asphalt mix. Other fill materials are subject to prior written approval by the Engineer.

END OF SECTION

SUBDRAIN SYSTEMS

1. GENERAL

1.1 Description

.1 This work shall consist of trenching, supplying and installing perforated pipe wrapped in filter fabric and backfill with select filter material at locations and to the depth and grade as established by the Engineer.

2. MATERIALS

2.1 Perforated Pipe

.1 Perforated PVC SDR 35 drain tile, nominal inside diameter 100 mm.

.2 Multi-flow drainage system – 150 mm diameter consisting of high density, polyethelene perforated tubes.

.3 Armtec weeping tile consisting of 100 mm diameter corrugated High Density polyethelene Big 'O' tubing.

2.2 Filter Fabric

.1 The Contractor shall supply filter sock or filter fabric material for wrapping the perforated pipe. Geotextile fabric to be interwoven, plastic, non-biodegradable type designed for separation of fill materials while permitting the movement of groundwater and shall be in accordance with the following:

PROPERTIES	ASTM TEST	REQUIREMENTS
PHYSICAL		
Grab tensile Strength	D4632	400 Newtons (N) Minimum
Grab Tensile Elongation	D4632	50% minimum
Mullen Burst	D3786	1275 KPa Minimum
Puncture	D4833	240 Newtons (N) Minimum
Trapezoid Tear	D4533	180 Newtons (N) Minimum
UV Resistance	D4355	70% @ 150 hr.
HYDRAULIC		
Apparent Opening Size	D4751	0.212 mm Minimum
Permittivity	D4491	2.1 sec^{-1}
Flow Rate	D4491	102 $1/sec/m^2$

2.3 Filter Material

.1 The Contractor shall supply filter material composed of hard, durable mineral particles free from organic matter, clay balls, soft particles and other deleterious

materials and meeting the following gradation requirements:

Sieve Size (microns)	Percent Passing By Weight
40 000	100
10 000	78 – 95
5 000	60 - 85
1 250	27 - 57
315	5 – 29
160	0 – 15
80	0 – 5

3. EXECUTION

3.1 Construction

.1 Trench Excavation

.1 Trenches shall be excavated to depths and grades as established by the Engineer. The trench shall be kept as narrow as practicable and still permit jointing to be done.

.2 The minimum width of the trench shall be the inside diameter of the pipe plus 0.25 m.

.3 The bottom of the trench shall be stable to afford a firm and uniform bearing throughout the entire length of the pipe. Where the bottom of the trench is in an impervious layer which has become wet and puddle, granular material shall be added to stabilize the trench bottom. However, the depth of gravel material shall be kept to a minimum to prevent possibilities of water flow under the subdrain pipe.

.2 Pipe Installation

.1 Perforated pipe shall be installed to the depth and grade as shown on the drawings or as directed by the Engineer. Perforations shall be oriented in directions as indicated by the Engineer, in accordance with the requirements for either collecting or carrying of water.

.2 Perforated pipe shall be installed on a stable pipe bed and be free of sags or high points.

.3 The pipe shall normally be joined with external “screw-on” couplers or “split” couplers. Couplers shall be of sufficient width to cover at least two outside crest corrugations on each end of the pipe to be joined.

.4 Plug upstream ends of drainage system with PVC plugs or caps.

.5 Perforated pipe shall be grouted into outfall locations such as manholes and catch basins.

.3 Filter Fabric Installation

.1 The perforated pipe shall be wrapped with filter fabric or fitted with a filter fabric sock prior to installation of the perforated pipe.

.4 Trench Backfill

.1 The subdrain trench shall be backfilled with pervious filter material conforming to Section 02620 Clause 2.3.1. Filter material shall be placed in 0.15 m layers, and shall be thoroughly tamped and carried to a minimum of 0.15 m above the seepage zone, or to a height as directed by the Engineer. The remainder of the trench shall be backfilled with impervious material and thoroughly compacted as per Section 03000.

END OF SECTION

PAVEMENT SURFACE CLEANING

1. GENERAL

1.1 Description

.1 This section specifies requirements for cleaning pavement surfaces prior to application of an asphalt overlay or pavement markings.

1.2 Related Work

.1	Pavement Markings General	Section 02570
.2	Painted Pavement Markings	Section 02571
.3	Spray Plastic Pavement Markings	Section 02573
.4	Cold Plastic Pavement Markings	Section 02574
.5	Pavement Marking Removal	Section 02577
.6	Prime, Tack and Fog Coats	Section 05110
.7	Asphalt Concrete	Section 05140

2. PRODUCTS

2.1 Materials

.1 Abrasives and solvents used for removal of paint, oil, grease, rubber deposits, etc. to be products specially designed for pavement cleaning, subject to the approval of Engineer.

3. EXECUTION

3.1 Pavement Surface Cleaning

.1 Remove to existing pavement level, any material which has protruded excessively and dispose of removed material as directed.

.2 Remove, by approved methods, dust, contaminants, loose and foreign materials, oil and grease, in areas designated.

.3 Use rotary power brooms or street sweeper supplemented by hand brooming as required.

.4 Keep storm drainage system clear of loose and waste materials.

END OF SECTION

ROADWAY SIGNS

1. GENERAL

1.1 Description

.1 This sections specifies the supply and installation of Regulatory Roadway Signs for the normal use of roadways.

1.2 Design Requirements

.1 Sign supports and appurtenances to be capable of withstanding summation of the following loads:

.1 Wind and ice loading specified to be consistent with anticipated loads in the City of Medicine Hat. Refer to the National Building Code of Canada and/or Provincial Building Code.

.2 Dead load of signboards, sign supports and appurtenances.

.3 Ice load on one face of signboards and around surface of all structural members and appurtenances.

.2 Structural deflections and vibration in accordance with American Association of State Highway and Transportation Officials (AASHTO), “Specification for the Design and Construction of Structural Supports for Highway Signs”.

1.3 Shop Drawings

.1 Submit shop drawings for signage structures indicating product data and design.

2. PRODUCTS

2.1 Sign Supports

.1 Steel posts:

.1 To CAN-G40.21, (4) m long, flanged “U” shaped in cross section, measuring (65) mm wide by (30) mm deep.

.2 Metal thickness: (4.5) mm.

.3 Hot dipped galvanized: to CAN/CSA-G164.

.4 Standard tubular supports for small signs: to ASTM B210M.

.2 Base plates:

.1 To ASTM B209M.

.3 Fasteners:

.1 Bolts, nuts, washers and other hardware for roadside signs to be cast aluminum alloy, or galvanized steel.

2.2 Signboards

.1 Aluminum sheet to ASTM B209M, pre-cut to required dimensions. Minimum thickness shall be 1.6 mm for signboards up to 750 mm wide. Minimum thickness for signboards 750 – 1200 mm wide shall be 2.0 mm.

.2 Connecting straps and bracket to ASTM B209M.

.3 3M HI-Intensity Scotchlite or equal approved by the Engineer.

2.3 Fabrication

.1 Signboards

.1 Aluminum blanks shall be degreased, etched and bonderized with chemical conversion coating. Clean surfaces with xylene thinner. Aluminum signboards shall be painted prior to installation. Spray and back face of signboards with two coats of enamel in accordance with CAN/CGSB-1.104.

3. EXECUTION

3.1 General

.1 The Engineer will provide plan layout information in the form of a base line for the installation of permanent signs. The Contractor shall establish the height and elevation of the sign and install it in accordance with the plans or as directed by the Engineer.

.2 The Contractor shall have all utilities located prior to digging holes for sign posts. Any adjustments to the location of the signs will be subject to the approval of the Engineer.

.3 Signs shall be mounted to the posts in accordance to Standard Drawing MW 200.

.4 The installed sign shall be clean and not bent or twisted. The reflectorized surface shall be free of scratches, dents and marks and must be securely fastened to the post.

.5 The disturbed area around all installations shall be restored to the original contours or as directed by the Engineer.

3.2 Installation of Breakaway Steel Posts

.1 Breakaway steel posts shall be installed to within 1.5 degrees of vertical and as indicated on the drawings.

.2 Breakaway steel posts are to be driven to the required depth without damage to the posts. If rock or concrete is encountered, auger the post holes to the required depth and backfill the post with material free of organics. All backfill shall be placed in 150 mm thick lifts and thoroughly compacted for the full depth.

.3 Damage to galvanized surfaces shall be repaired by treating the damaged areas with zinc rich paint conforming to MIL SPEC DOD-P-21035.

3.3 Installation of Wooden Posts

.1 Wooded posts shall be installed to within 1.5 degrees of vertical and as indicated on the drawing.

.2 Wooden posts shall be set in augured holes to the required depth. The wooden post shall be backfilled with material free of organics. Backfill shall be placed in 150 mm thick lifts and thoroughly compacted for the full depth.

3.4 Installation of Concrete Bases

.1 Concrete bases shall be installed as shown on the drawings. The Contractor shall excavate hole to a minimum of 300 mm larger than the base and the base shall be installed in the centre of the excavation. The concrete base shall be backfilled with material free of organics. Backfill shall be placed in 150 mm thick lifts and thoroughly compacted for the full depth.

END OF SECTION

EXCAVATION, TRENCHING AND BACKFILLING

1. GENERAL

1.1 Description

.1 This section specifies requirements for, Bedding Classes and Bedding Materials, Excavation, Trenching and Backfill of Storm Sewers and Catch Basin Leads.

1.2 Related Work

.1 Safety Requirements.....Section 01500

.2 Temporary Fencing.....Section 01520

.3 Subdrain Systems .....Section 02620

.4 Storm Sewers.....Section 03100

.5 Catch Basin Leads .....Section 03125

.6 Manholes and Catch Basins.....Section 03150

.7 Cast-in-Place Concrete……....Section 03300

.8 Backfill Regulations for Public Right-of-Ways.....Section 06000

1.3 References

.1 City of Medicine Hat Temporary Traffic Control Manual.

.2 ASTM C117-04 Test Method for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.

.3 ASTM C136-06 Method for Sieve Analysis of Fine and Coarse Aggregates.

.4 ASTM D698-07 Test Methods for Moisture Density Relations of Soils and Soil Aggregate Mixtures Using 2.49 kg Hammer and 304.8 mm Drop.

.5 CAN/CGSB, Sieves, Testing, Woven Wire, Metric.

1.4 Definitions

.1 **Unclassified Excavation:** all excavated material regardless of its nature or composition, that is not specified elsewhere.

.2 **Rock Excavation**: excavation of material from solid masses of igneous, sedimentary or metamorphic rock which, prior to its removal, was integral with its parent mass, and boulders or rock fragments having individual volume in excess of 1 m^3.

.3 **Common Excavation**: excavation of materials of whatever nature, which are not included under definitions of rock excavation including dense tills, hardpan and frozen materials.

.4 **Bedding Material**: materials placed at the bottom of the trench beneath and up to the spring line of the pipe, as specified and approved by the Engineer.

.5 **Pipe Foundation**: subgrade material immediately below bedding.

.6 **Initial Backfill**: material placed within the trench, above the spring line of the pipe to 300 mm above the crown of the pipe.

.7 **Bedding Class**: pipes to be bedded to one of the following classes, as specified by the Engineer or shown on the Construction Drawings.

.1 Class A Bedding

.1 Concrete Cradle:

.1 Pipe is bedded in concrete up to ¼ of the outside pipe diameter, for a minimum width of pipe diameter plus 200 mm. Above cradle, Type 1 granular fill shall be placed and compacted to 300 mm above pipe to a minimum 95% of standard Proctor maximum dry density and moisture conditioned by drying or by adding water, to obtain an in-place moisture content ± 2% of the optimum moisture content as determined by ASTM D698 (Method C) over the full width of the cross section.

.2 Concrete Arch:

.1 Pipe is bedded in Type 1 granular fill to spring line of the pipe and compacted to a minimum 95% of standard Proctor maximum dry density and moisture conditioned by drying or by adding water, to obtain an in-place moisture content ± 2% of the optimum moisture content as determined by ASTM D698 (Method C) over the full width of the cross section. Top half of pipe is covered with concrete to minimum of pipe outside diameter plus 200 mm.

.3 Concrete Encasement:

.1 Pipe is bedded in concrete up to ¼ of the outside pipe diameter, for a minimum width of pipe diameter plus 200 mm and to a minimum of 300 mm above pipe.

.4 Concrete required for Class A bedding shall be either Normal Density Concrete or Non Shrink Concrete (filcrete) as directed by the Engineer. All concrete shall be in accordance with Section 03300 Cast-in-Place Concrete.

.2 Class B Bedding

.1 Shaped Subgrade:

.1 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 Type 3 granular bedding. Once pipe is installed to the required grade and elevation, additional Type 3 granular bedding shall be placed and compacted up to the spring line of the pipe compacted to a minimum 95% of standard Proctor maximum dry density and moisture conditioned by drying or by adding water, to obtain an in-place moisture content ± 2% of the optimum moisture content as determined by ASTM D698 (Method C) over the full width of the cross section. Type 4 native backfill shall then be placed and compacted to 300 mm above pipe to a minimum 95% of standard Proctor maximum dry density and moisture conditioned by drying or by adding water, to obtain an in-place moisture content ± 2% of the optimum moisture content as determined by ASTM D698 over the full width of the cross section.

.2 Granular Bedding:

.1 Pipe is bedded on Type 2 fill (screened rock) placed on a flat trench bottom, depth of bedding to be:

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

.2 Type 2 fill shall then be placed and consolidated using hand compaction equipment up to the spring line of the pipe. As directed by the Engineer, Type 1 Granular or Type 4 Native fill materials shall then be placed and compacted to 300 mm above the crown of the pipe, compacted to a minimum 95% of standard Proctor maximum dry density and moisture conditioned by drying or by adding water, to obtain an in-place moisture content ± 2% of the optimum moisture content as determined by ASTM D698 over the full width of the cross section.

.3 Non Shrink Bedding:

.1 Controlled density, low strength concrete used as trench backfill material where specified by Engineer. Concrete for non shrink bedding shall be in accordance with Section 03300 Cast-in-Place Concrete and Section 06000 Backfill Regulations for Public Right-of-Ways.

2. PRODUCTS

2.1 Materials

.1 Type 1 Granular Fill:

.1 Crushed stone or gravel consisting of hard durable particles free from clay lumps, cementation, organic material, frozen material and other deleterious materials.

.2 Gradations to be within limits specified when tested to ASTM C136-06 and ASTM C117-04. Sieve sizes to CAN/CGSB 8.2 - M88.

Sieve Size (microns)	% Passing By Weight
20 000	100
16 000	84 – 94
10 000	63 – 86
5 000	40 – 67
1 250	20 – 43
630	14 – 34
315	9 – 26
160	5 – 18
80	2 - 10

.2 Type 2 Fill (Screened Rock):

.1 Screened stone consisting of hard durable particles free from clay lumps, cementation, organic material, frozen material and other deleterious materials.

.2 Gradations to be within limits specified when tested to ASTM C136-06 and ASTM C117-04. Sieve sizes to CAN/CGSB 8.2 - M88.

Sieve Size (microns)	% Passing By Weight
40 000	100
20 000	45 - 90
5 000	10 - 40
2 000	0 - 10

.3 Type 3 Granular Bedding Fill:

.1 Sand consisting of hard durable particles free from clay lumps, cementation, organic material, frozen material and other deleterious materials.

.2 Gradations to be within limits specified when tested to ASTM C136-06 and ASTM C117-04. Sieve sizes to CAN/CGSB 8.2 - M88.

Sieve Size (microns)	% Passing By Weight
1 250	100
1 000	80 - 100
5 000	70 - 90
630	30 - 60
160	10 - 25
80	5 - 15

.4 Type 4 Native Fill:

.1 Selected material from excavation or other sources, approved by Engineer for use intended, unfrozen and free from rocks larger than 75 mm, cinders, ashes, sods, refuse or other deleterious materials.

2.2 Samples

.1 At least 1 week prior to commencing work, inform the Engineer of proposed source of fill materials and provide access for sampling.

3. EXECUTION

3.1 Safety Requirements

.1 All safety requirements shall be followed as per Section 01500.

3.2 Traffic Control

.1 All Traffic Control shall be in accordance with the most recent City of Medicine Hat Temporary Traffic Control Manual..

3.3 Protection of Existing Features

.1 Existing buried utilities and structures:

.1 Size, depth and location of existing utilities and structures, as indicated, are taken from available record drawings and are for guidance only. Completeness and accuracy are not guaranteed.

.2 At least one week prior to commencing any excavation work, contact utility companies or applicable authority to establish location and state of use of buried utilities and structures. Clearly mark locations to prevent disturbance during work.

.3 Confirm locations – reference 01500 Safety Requirements Section 2.4.

.4 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered. Obtain direction of Engineer before moving or otherwise disturbing utilities or structures.

.5 Record locations of maintained, re-routed and abandoned underground lines.

.2 Existing buildings and surface features:

.1 Conduct, with Engineer, condition survey of existing buildings, trees and other plants, lawns, fencing, service poles, wires, paving, concrete sidewalks, curbs, gutters, survey bench marks and monuments which may be affected by work.

.2 Protect existing buildings and surface features which may be affected by work from damage while work is in progress, and repair damage resulting from work at no cost to the owner.

.3 Where excavation necessitates root or branch cutting, do so only as approved by the Engineer.

3.4 Site Preparation

.1 Remove obstructions, ice and snow, from surfaces to be excavated.

.2 Cut pavement or sidewalk neatly along limits of proposed excavation in order that surface may break evenly and cleanly.

.3 Strip top soil from within limits of excavation and stockpile as directed by the Engineer for re-spreading after backfilling.

3.5 Dewatering and Heave Prevention

.1 Keep excavations free of water while work is in progress.

.2 Avoid excavations below groundwater table if quick condition or heave is likely to occur. Prevent piping or bottom heave of excavations by groundwater lowering, sheet pile cut-offs, or other means.

.3 Protect all open excavations against flooding and damage due to surface run-off.

.4 Dispose of water in a manner not detrimental to public and private property, or any portion of work completed or under construction.

.5 Submit details of proposed dewatering or heave prevention methods, such as dikes, well points and sheet pile cut-off to the Engineer's for review prior to construction.

3.6 Stockpiling

.1 Stockpile all fill and excavated materials in areas designated by Engineer. Stockpile granular materials in manner to prevent segregation.

.2 Protect all fill and excavated materials from contamination.

3.7 Shoring, Bracing and Underpinning

.1 Whenever shoring, sheeting, timbering and bracing of excavations is required, engage services of a professional engineer, who is registered in the Province of Alberta, to design and assume responsibility for adequacy of shoring and bracing.

.2 When requested by the Engineer, submit for review Drawings and calculations signed and stamped by the professional engineer responsible for the preparation.

.3 Close sheeting, when required, to be designed and constructed to prevent adjacent soil or water from entering excavation.

.4 Construct temporary works to depths, heights and locations as approved by Engineer.

.5 During backfill operation:

.1 Unless otherwise indicated by Engineer, remove sheeting and shoring from excavations.

.2 Do not remove bracing until backfilling has reached respective levels of such bracing.

.3 Pull sheeting in increments that will ensure compacted backfill is maintained at an elevation at least 500 mm above toe of sheeting.

.6 When sheeting is required to remain in place, cut off tops at elevations as indicated or as directed by Engineer.

.7 Upon completion of substructure construction:

.1 Remove shoring and bracing.

.2 Remove excess materials from site and restore water courses as indicated and as directed by Engineer.

3.8 Excavation

.1 Excavate to lines, grades, elevations and dimensions as indicated or as directed by Engineer.

.2 Excavation must not interfere with normal 45° splay of bearing from bottom of any footing.

.3 For trench excavation, unless otherwise authorized by Engineer in writing, do not excavate more than 30 m of trench in advance of installation operations and do not leave open more than 15 m at end of day's operation.

.4 Dispose surplus excavation material as directed by the Engineer.

.5 Do not obstruct flow of surface drainage or natural water courses.

.6 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.

.7 Notify Engineer when bottom of excavation is reached.

.8 Notify Engineer when bottom of excavation appears unsuitable for foundation and installation.

.9 Remove unsuitable material from trench bottom to extent and depth as directed by Engineer.

.10 Obtain Engineer's approval of completed excavation.

.11 Where required due to unauthorized over excavation, correct as follows:

.1 Fill under bearing surfaces and footings with Non Shrink Concrete in accordance with Section 03300 - Cast in Place Concrete.

.2 Fill under other areas with Type 1 granular fill compacted to minimum of 95% standard Proctor maximum dry density and moisture conditioned by drying or by adding water, to obtain an in-place moisture content ± 2% of the optimum

moisture content as determined by ASTM D698 over the full width of the cross section.

.12 Hand trim, make firm and remove loose material and debris from excavations. Where material at the bottom of the excavation is disturbed, compact the foundation soil to a density at least equal to undisturbed soil. Clean out rock seams and fill with concrete mortar or grout to approval of Engineer.

3.9 Pipe Bedding and Initial Backfill

.1 Concrete Bedding and Encasement

.1 Do concrete work to Section 03300 - Cast in Place Concrete. Place concrete to details indicated on the drawings or as directed by the Engineer.

.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 placement.

.2 Granular Bedding

.1 Place granular bedding materials to Class B Bedding requirements unless otherwise indicated on the drawings or directed by the Engineer.

.2 Shape the pipe bed true to grade to provide a continuous uniform bearing surface for the full length of the pipe exterior. Do not use blocks when bedding pipe.

.3 Shape transverse depressions in bedding as required to complete joints.

.4 Place bedding backfill layers simultaneously on both sides of the installed work to equalize loading.

.5 No bedding and initial backfill materials shall be permitted to be dropped directly on the pipe further than a distance of 500 mm.

.3 Lean-crete Plugs

.1 Lean-crete plugs to prevent movement of groundwater through granular pipe bedding and initial backfill, shall be installed as directed by the Engineer or as shown on the drawings.

.2 Lean-crete shall be in accordance with Section 03300. Size of plugs shall be from 500 mm below the pipe to 30 mm above the pipe for a distance of one meter. Plugs shall be installed a minimum of 750 mm from any pipe joint.

3.10 Backfilling

.1. Do not proceed with backfilling operations until Engineer has inspected and approved installations.

.2 Areas to be backfilled are to be free from debris, snow, ice, water and frozen ground.

.3 Do not use backfill material which is frozen or contains ice, snow or debris and rocks larger than 150 mm.

.4 Place backfill materials in uniform layers not exceeding 300 mm un-compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.

.5 Backfilling around installations.

.1 Place bedding and surround material in accordance with this section.

.2 Placement and compaction of trench backfill shall be in accordance with Section 06000.

.3 Do not backfill around or over cast-in-place concrete within 24 hours after placing.

.4 Backfill materials shall be placed simultaneously on both sides of the installed works to equalize loading. The difference on each side shall not exceed 150 mm.

.5 Where temporary unbalanced earth pressures are liable to develop on walls or other structures:

.1 Permit concrete to cure for minimum 7 days or until it has sufficient strength to withstand earth and compaction pressure and approval is obtained from Engineer or

.2 With approval of the Engineer, erect bracing or shoring to counteract unbalance, and leave in place until removal is approved by Engineer.

3.11 Inspection and Testing

.1 Testing of materials and compaction will be carried out by testing laboratory designated by the Owner or Engineer. Frequency of tests will be determined as specified in Section 6000 Backfill Regulations for Public Right-of-Ways.

.2 The Contractor shall coordinate testing carried out by the Owner's or Engineers representative with the backfilling operations.

.3 The costs of retesting of materials and compaction due to failure to meet specified requirements will be borne by the Contractor.

3.12 Restoration

.1 Upon completion of Work, remove surplus materials and debris, trim excavated areas to final design grades, and correct defects as noted by Engineer.

.2 Replace topsoil as indicated or directed by Engineer.

.3 Clean and reinstate areas affected by Work as directed by Engineer.

.4 Dispose surplus excavated materials off site.

END OF SECTION

1. GENERAL

1.1 Description

.1 This section specifies requirements for the supply and installation of storm sewer mains and catch basin leads.

1.2 Related Work

.1 Safety Requirements.....Section 01500

.2 Temporary Fencing.....Section 01520

.3 Excavation, Trenching and Backfilling.....Section 03000

.4 Manholes and Catch Basins.....Section 03050

.5 Backfill Regulations for Public Right-of-Ways.....Section 06000

1.3 References

.1 City of Medicine Hat Temporary Traffic control Manual 2008.

.2 ASTM C136, Method for Sieve Analysis of Fine and Coarse Aggregates.

.3 ASTM F974, ASTM D3034 - (85b), CAN3-B182.1, and CAN3 B182.2, CSA B182.4 Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

.4 ASTM C14, Specification for Non-Reinforced Circular Concrete Pipe.

.5 ASTM C76, Specification for Reinforced Circular Concrete Pipe.

.6 ASTM C443, Specification for Flexible Rubber Gasket Joints.

.7 CSA B181.12-(1967), Recommended Practice for the Installation of PVC drain, Waste and Vent Pipe Fittings.

.8 CAN/CSA-A3000 - 08, Portland Cement.

.9 CAN/CSA23.1.0.4, Concrete Materials and Methods for Concrete Construction.

.10 ASTM D698, Test Methods for Moisture Density Relations of Soils and Soil Aggregate Mixtures Using 2.49 kg Rammer and 304.8 mm Drop.

1.4 Samples

.1 Submit Shop Drawings, Product Data, Samples and Mock-ups.

.2 At least two weeks prior to commencing work, inform the Engineer of proposed source of bedding materials and provide access for sampling.

1.5 Scheduling of Work

.1 Schedule work to minimize interruptions to existing services.

.2 Maintain existing flows during construction.

.3 Submit schedule of expected interruptions for approval and adhere to approved schedule.

2. PRODUCTS

2.1 Plastic Pipe

.1 Type PSM Polyvinyl Chloride (PVC): to ASTM D3034.

.1 Standard Dimensional Ratio (SDR): 35.

.2 Locked-in gasket and integral bell system.

.3 Nominal lengths: 4 m.

.4 Approved product: Ultra-Rib

2.2 Concrete Pipe

.1 C76 Class I, II, III and IV Concrete.

.1 Nominal lengths: 2.5 m.

2.3 Pipe Bedding and Surround Material

.1 As directed by Engineer in accordance with Section 03000 – Excavating, Trenching and Backfilling.

2.4 Backfill Material

.1 As directed by Engineer in accordance with Section 03000 – Excavating, Trenching and Backfilling and Section 06000 Backfill Regulations for Public Right-of-Ways.

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

.1 Do trenching work in accordance with Section 03000 - Excavating, Trenching and Backfilling.

.2 Do not allow contents of any sewer or sewer connection to flow into trench.

.3 Trench alignment and depth is to be approved by the Engineer prior to placing bedding material and pipe.

3.4 Granular Bedding

.1 Place all fill types as specified in Section 03000 – Excavating, Trenching and Backfilling in uniform layers not exceeding 200mm un-compacted thickness to minimum 100mm depth.

.2 Shape the pipe bed true to grade to provide a continuous uniform bearing surface for the pipe. Do not use blocks when bedding pipe.

.3 Shape transverse depressions as required to suit joints.

.4 Compact each layer full width of bed to a minimum of 95% of Standard Proctor Density.

3.5 Installation

.1 Lay and join pipe in accordance with manufacturer's recommendations.

.2 All pipe shall be handled by approved methods. Do not use chains or cables passed through rigid pipe bore so that the weight of pipe does not bear upon the ends of pipe.

.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 installing pipe at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.

.5 Do not exceed maximum joint deflection 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 methods approved by the manufacturer.

.9 Install PVC, Concrete pipes and fittings in accordance with manufacturer’s recommendations.

.10 When any stoppage of work occurs restrain pipes, as directed by the Engineer, to prevent "creep" during down time.

.11 Cut pipes as required for special inserts, fittings or closure pieces in neat manner, as recommended by pipe manufacturer, without damaging pipe or its coating, and to leave smooth end at right angles to axis of pipe.

.12 Make watertight connections to manholes and catch basins. Use shrinkage compensating grout when suitable gaskets are not available.

3.6 Pipe Surround

.1 Upon completion of pipe laying, and after the Engineer has inspected work in place, place and compact pipe surround material as specified in Section 03000 – Excavating, Trenching and Backfilling.

.2 Hand place pipe surround material in uniform layers not exceeding 200mm un-compacted thickness. Compaction shall be in accordance with Section 0300 – Excavating, Trenching and Backfilling. Do not dump material over 600mm from the top of pipe.

.3 Place layers uniformly and simultaneously on each side of pipe.

3.7 Trench Backfill

.1 Place and compact backfill materials above pipe surround, in uniform layers as indicated in Section 03000 Excavation, Trenching and Backfilling and Section 6000 Backfill Regulations for Public Right-of-Ways.

3.8 Field Testing

.1 Repair or replace pipe, pipe joint or bedding found defective.

.2 When directed by the Engineer, draw tapered wooden plug with diameter of 95% of inside diameter of pipe through storm sewer to ensure that pipe is free of defects and obstructions.

.3 Remove foreign material from sewers and related appurtenances by flushing with water.

3.9 Surface Restoration

.1 After installing and backfill over storm sewer mains, restore surface as specified in Section 03000 Excavation, Trenching and Backfilling.

3.10 Sewer Inspection by CCTV (closed circuit television)

.1 All Storm Sewer Mains shall be inspected by CCTV after backfilling of the trench to finished grade. CCTV inspection shall be performed by the Contractor on all Storm Sewer Mains unless otherwise directed by the Engineer. The Contractor shall employ a qualified CCTV Contractor acceptable to the owner.

.2 Sewer Mains shall be flushed prior to the CCTV Inspection. The CCTV Inspection shall be performed immediately after the Sewer Mains have been flushed.

.3 All CCTV inspections shall be carried out in the presence of the Engineer, who shall be given at least 48 hours advance notice of any testing to be carried out.

.4 Two (2) copies of the CCTV video and report shall be submitted to the Engineer.

.5 Acceptance of CCTV inspections shall be based on the City of Medicine Hat Municipal Works Department review of all submitted materials.

3.11 CCTV Inspection Equipment

.1 The CCTV Contractor shall provide all equipment and materials necessary to conduct the inspection as specified herein.

.2 The CCTV Operator shall be certified by NAAPI and certification shall be supplied prior to commencing the work.

.3 The CCTV equipment shall be self-contained camera and monitoring unit connected by cable. It must be waterproof and be capable of lighting the entire pipe. Picture capabilities must be of quality to show the entire pipe periphery. There must be capability of providing measurement within the line to any accuracy of one-third of a metre per kilometre. Picture quality must be such to produce a continuous 600 line resolution picture showing the entire periphery of the pipe. The following capabilities and items must be available:

.1 A direct voice communication.

.2 A camera towing service or crawler mounted solid state camera.

.3 Self-contained electrical power.

.4 Proper safety equipment to protect employees and the general public.

.5 Position camera lens centrally in the pipeline with a positioning tolerance of +-10% off the vertical centreline axis of the pipeline.

.6 The camera's rate of progress shall be uniform during inspection and shall not exceed the following limits:

.1 0.10 m/s for pipe diameters less than 200 mm.

.2 0.15 m/s for pipe diameters 200 mm and larger but not exceeding 310 mm.

.3 0.20 m/s for pipe diameters exceeding 310 mm.

3.12 CCTV Report

.1 A CCTV log shall be maintained during the inspection showing location of leak, fault, open joint, break, crack, collapse, settlement, obstruction, infiltration, or any other defect affecting the overall performance of the sewer line. The location of the defect shall be referenced from the manhole.

.2 Manhole identity shall be noted clearly as indicated on the drawings.

.3 Two (2) copies of the final typewritten report with corresponding video referenced to the text, along with two (2) copies of the video tape, shall be submitted within two weeks after compilation of inspection.

.4 Pipe condition comments made in the report shall be in Industry Standard Terminology.

3.13 CCTV Cleaning and Flushing

.1 The Contractor is responsible for cleaning and flushing all Storm Sewer Mains.

3.14 CCTV Miscellaneous

.1 The Contractor shall be responsible for all works performed by the subcontractor, for traffic control and any other related work incidental to the completion of the CCTV inspection.

3.15 CCTV Inspection and Acceptance

.1 The location of all deficient work will be recorded and the Contractor will be required to repair, restore or otherwise make good, to the satisfaction of the Engineer, any deficient work including the repair of alignment problems, cracked or broken pipe, deformed pipe, leaks or any other faults not conforming with these specifications or the pipe manufacturers which the CCTV inspection revealed.

.2 After the deficiencies are repaired and corrected and before final acceptance, the Owner reserves the right to have the faulty areas re-televised at the Contractor's expense.

END OF SECTION

CATCH BASIN LEADS

1. GENERAL

1.1 Description

.1 This section specifies requirements for the supply and installation of Polyvinyl Chloride (PVC) and Concrete pipe catch basin leads.

1.2 Related Work

.1 Safety Requirements……..……...…….Section 01500

.2 Temporary Fencing……...…Section 01520

.3 Excavating, Trenching and Backfilling.....Section 03000

.4 Storm Sewers.....Section 03100

.5 Manholes and Catch Basins.....Section 03150

.6 Cast-in- Place Concrete .....Section 03300

1.3 References

.1 City of Medicine Hat Temporary Traffic Control Manual.

.2 ASTM C136M, Method for Sieve Analysis of Fine and Coarse Aggregates.

.3 ASTM F794, ASTM D3034 - (85b), CAN3-B182.1, and CAN3 B182.2, CSA B182.4 Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

.4 ASTM C14M, Standard Specification for Non-Reinforced Concrete Sewer, Storm Drain and Culvert Pipe.

.5 ASTM C76M-08a, Standard Specification for Reinforced Concrete Sewer, Storm Drain and Culvert Pipe.

.6 ASTM C443M, Standard Specification for Concrete Pipe and Manholes using Rubber Gaskets.

.7 CSA B1800-02, Recommended Practice for the Installation of PVC drain, Waste and Vent Pipe Fittings.

.8 CAN/CSA-A3000-08, Portland Cement.

.9 CAN/CSA23.1-04, Concrete Materials and Methods of Concrete Construction.

.10 CAN/CSA23.2-04, Methods of Test and Standard Practices For Concrete.

.11 ASTM D698, Standard Test Methods for laboratory compaction characteristics of soil using standard effort (12,400 ft-lbf/ft^3 (600 kN – m/m^3)).

.12 ASTM D2412 Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel Plate Loading.

2. PRODUCTS

2.1 Materials

.1 Ultra Rib PVC Pipe:

.1 Ultra-Rib PVC pipe and fittings to meet CSA B182.4, ASTM F794 and having a minimum diameter of 250 mm to a maximum diameter of 600 mm diameter.

.2 Locked-in gasket and integral bell system.

.3 Minimum pipe stiffness to be 320 KPa as measured in accordance with ASTM D2412.

.4 Gaskets to be designed for Ultra-Rib pipe and shall meet the requirements of ASTM F794.

.5 Nominal lengths: 4 meters.

.6 Any colour except blue.

.2 SDR-35 PVC Pipe:

.1 Type PSM Polyvinyl Chloride (PVC): to ASTM D3034 – (85b), and CAN/CSA B1800-02.

.2 Standard Dimensional Ration (SDR): 35.

.3 Minimum diameter: 250mm. Maximum diameter: 600mm.

.4 Locked-in gasket and integral bell system.

.5 All pipe joints to meet the requirements of specification for joints for drain and sewer plastic pipes using flexible elastomeric seals .

.6 Nominal length: 4 meters.

.7 Any colour except blue.

.3 Concrete Pipe:

.1 ASTM C76M, Class I, II, III, and IV Concrete.

.2 Sulphate resistant (Type HS) pipe.

.3 Non-reinforced circular concrete pipe and fittings to ASTM C14M designed for flexible rubber gasket joints to ASTM C443M.

.4 Reinforced circular concrete pipe and fittings to ASTM C76M designed for flexible rubber gasket joints to ASTM C443M.

.5 Locked in Isoprene O-Ring Gaskets and integral bell system.

.6 Minimum diameter: 250 mm. Maximum diameter: 600 mm.

.7 No lift holes.

.8 Nominal length: 2.44 meters

.4 Non Shrink Grout:

.1 To Section 03300 Cast-in-Place Concrete.

3. EXECUTION

3.1 Safety Requirements

.1 All safety requirements shall be followed as per Section 01500.

3.2 Traffic Control

.1 All traffic control shall be in accordance with the most recent City of Medicine Hat Temporary Traffic Control Manual.

3.3 Excavation, Trenching and Backfill

.1 Perform excavation, trenching and backfill in accordance with Section 03000 - Excavation, Trenching and Backfilling and Section 06000 Backfill Regulations for Public Right-of-Ways.

.2 Prior to installation of catch basin leads obtain Engineer's approval.

3.4 Concrete Work

.1 Do concrete work in accordance with Section 03300 - Cast-in-Place Concrete.

3.5 Installation

.1 Trenching, bedding, and backfill for the installation of catch basin leads shall be performed as per Section 03000 – Class B Bedding unless otherwise noted on the construction drawings.

.2 Excavate trench line and install catch basin lead to grade as established by the Engineer.

.3 Catch basin leads shall be installed at a minimum of 1% grade between the manhole and catch basin through the entire lead.

.4 Lay, join pipe and install rubber gaskets and couplers in accordance with manufacturer's recommendations.

.5 Ensure that the bottom of the pipe is in contact with the shaped bed or granular bedding throughout its length.

.6 Do not backfill until pipe grade and alignment has been inspected by the Engineer.

3.6 Connection to Catch Basins and Manholes

.1 Break out opening in catch basin or manhole to suit pipe diameter.

.2 Cut pipe to conform to the inside wall of catch basin or manhole. Catch basin leads must protrude between 50 mm and 100 mm from the inside wall of the catch basin or manhole.

.3 Grout pipe in place using non shrink grout as per Section 03300 Cast-in-Place Concrete.

3.7 Backfilling and Compaction

.1 Backfill and compact in accordance with Section 03000 – Excavating, Trenching and Backfilling, and Section 06000 – Backfill Regulations for Public Right-of-Ways.

End of Section

STORM MANHOLES AND CATCH BASINS

1. GENERAL

1.1 Description

.1 This section specifies requirements for the supply and installation of storm sewer manholes and catch basins

1.2 Related Work

.1 Safety Requirements……..……...Section 01500

.2 Temporary Fencing……...……Section 01520

.3 Excavating, Trenching and Backfilling.....Section 03000

.4 Catch Basin Leads.....Section 03125

.5 Cast- in- Place Concrete .....Section 03300

.6 Backfill Regulations for Public Right-of-Ways……...Section 06000

1.3 References

.1 City of Medicine Hat Temporary Traffic Control Manual.

.2 ASTM A48M, Standard Specification for Grey Iron Castings.

.3 ASTM A536M, Standard Specification for Ductile Iron Castings.

.4 CAN/CSA A165-04, Concrete Masonry Units.

.5 ASTM C478M-09, Standard Specification for Precast Reinforced Concrete Manhole Sections.

.6 CSA G30.12, Specification for Billet Steel Deformed Bars.

.7 CAN/CSA-A3000-08, Portland Cement.

.8 CAN/CSA-A23.1.04, Concrete Materials and Methods of Concrete Construction.

.9 CAN/CSA 23.2-04, Methods of Testing and Standard Practises for Concrete.

.10 CSA G164-M1981, Hot Dip Galvanizing of Irregularly Shaped Articles.

.11 ASTM D698, Standard Test Methods for laboratory compaction characteristics of soil using standard effort (12,400 ft-lbf/ft³ (600 kN – m/m³)).

2. PRODUCTS

2.1 Materials

.1 Concrete: to Section 03300 – Cast-in-Place Concrete.

.2 Precast manhole section: to ASTM C478M-09 circular. Top sections flat slab top type with opening offset for vertical ladder installation. Monolithic bases to be approved by the Engineer.

.3 Precast catch basin sections: to ASTM C478M-09.

.2 Joints:

.1 Manhole joints: to be made watertight using bituminous compound (Rub-R-Nec or Conseal) or other approved sealant. Joints between slab top, concrete and neoprene adjusting rings do not require bituminous compound.

.2 Catch basin joints: catch basin barrel and slab top joints do not require bituminous compound.

.3 Non Shrink Grout and Dry Pack:

.1 To Section 03300 - Cast-in-Place Concrete.

.4 Ladder rungs: to CSA G30.12, #25M billet steel deformed bars, hot dipped galvanized to CSA G164M or aluminium (20 mm). Rungs to be safety pattern (drop step type).

.5 Adjusting rings: to ASTM C478M-09. Infra–Riser Multi-Purpose Rubber Adjustment Riser (or equivalent).

.6 Concrete brick: to CAN3-A165 Series.

.7 Storm sewer manholes: Type 5-A and Type 1-S as indicated on Standard Drawings manufactured with sulphate resistant (Type HS) cement.

.8 Catch basins: Type K-1 and Type K-7 as indicated on Standard Drawings.

.9 Frames, gratings, covers to following requirements:

.1 Metal gratings and covers shall bear evenly on frames. A frame with grating or cover shall constitute one unit. Assemble and mark unit components before shipment.

.2 Grey iron castings: to ASTM A48M strength Class 20.

.3 Ductile iron castings: to ASTM A536, Class 60-40-18.

.4 Castings to be coated with two applications of asphalt varnish sand blasted or cleaned and ground to eliminate surface imperfections.

.5 Shallow manhole frames and covers: minimum 160 kg per set; heavy duty municipal type for road service; cover cast without perforations and complete with two 25 mm square lifting holes, as approved by the Engineer.

.6 Catch basin frames and covers shall consist of a side inlet, catch basin grate and catch basin frame. Minimum 198 kg. per set or as approved by the Engineer.

3. EXECUTION

3.1 Safety Requirements

.1 All safety requirements shall be followed as per Section 01500.

3.2 Traffic Control

.1 All traffic control shall be in accordance with the most recent City of Medicine Hat Temporary Traffic Control Manual.

3.3 Excavation, Trenching and Backfill

.1 Perform excavation, trenching and backfill in accordance with Section 03000 - Excavation, Trenching and Backfilling and Section 06000 Backfill Regulations for Public Right-of-Ways.

.2 Prior to installation of manholes or catch basins obtain Engineer's approval.

3.4 Concrete Work

.1 Do concrete work in accordance with Section 03300 - Cast-in-Place Concrete.

.2 Position metal inserts in accordance with dimensions and details as indicated.

3.5 Installation

.1 Install manholes and catch basins in accordance with details indicated, plumb and true to alignment and grade.

.2 Install manholes and catch basins with the progress of pipe installation. Maximum of three units behind point of pipe laying will be allowed.

.3 Dewater excavation as directed by the Engineer and remove soft and foreign material before placing concrete bases.

.4 Cast-in-place bottom slabs and bases shall be installed on undisturbed ground.

.5 Set precast concrete bases on 150 mm minimum depth of Type 1 granular fill or Type 2 fill (screened rock) as per Section 03000. Type 1 granular fill shall be compacted to a minimum 98% standard Proctor maximum dry density, moisture conditioned by drying or by adding water, to obtain an in-place moisture content of ± 2% of the optimum moisture content as determined by ASTM D698 over the full width of the cross section.

.6 Pre-cast manhole barrels:

.1 When setting pre-cast manhole barrels to cast-in-place bottom slabs or bases the pre-cast shall be set in a bed of cement mortar and bond to cast-in-place concrete slab or base. Make each successive joint watertight as follows.

.1 Manhole joints: to be made watertight using bituminous compound (Rub-R-Nec or Conseal) or other approved sealant. Joints between slab top, concrete and neoprene adjusting rings do not require bituminous compound or mortar.

.7 Catch basin joints:

.1 Catch basin barrel and catch basin slab top joints do not require bituminous compound unless directed by the Engineer. Cement mortar shall be used between the slab top and steel frame and shall be water tight.

.8 Clean surplus mortar and joint compounds from interior surface of unit as work progresses.

.9 Plug lifting holes with (precast) concrete plugs set in cement mortar or mastic compound.

.10 For storm sewers:

.1 Place stub outlets and plugs at elevations and in positions indicated.

.2 Bench to provide a smooth U-shaped channel. Side height of channel to be 0.50 times the outside diameter of the sewer pipe. Slope adjacent floor at 1:10. Curve channels smoothly. Slope invert to establish sewer grade. For sewer pipe smaller than 300 mm diameter use standard fittings, breaking out upper half of fitting upon completion of manhole.

.11 Installing manholes and catch basins in existing systems:

.1 Where a new unit is to be installed in an 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 the existing pipe.

.3 Where deemed expedient to maintain service around existing pipes once the system is ready to be put in operation, complete the installation with appropriate break-outs, removals, redirection of flows, blocking unused pipes or other necessary work.

.12 New Manhole Adjustments:

.1 Set manhole frame and cover to required elevation on no more than three concrete adjustment rings (maximum 150 mm total height). Wood or steel shims shall not be used to level the adjustment rings or frames.

.2 The final 25 mm shall be adjusted utilizing a Infra-Riser multi-purpose adjustment riser ring (or equivalent) directly beneath the frame and cover assembly.

.3 Depth from top of manhole cover to first ladder rung shall not exceed 600 mm. Manhole shall be reconfigured as necessary. No ladder rungs will be permitted to be installed into the riser rings.

.4 Manhole frame and cover shall be installed 5 mm below finished surface elevation.

.13 Existing Manhole Adjustments:

.1 Sectional Units:

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

.2 Raise or lower straight walled sectional units by removing slab top and adding or removing precast sections as required.

.3 Raise or lower tapered unit by removing cone section, adding, removing, or substituting riser sections to obtain required elevation, then replace cone section with slab top.

.4 When the amount of rise is less than 75 mm use steel adjustment riser rings.

.2 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 Then monolithic units with tapered upper section are to be lowered more than 50 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 when applicable.

.6 Set manhole frame and cover to required elevation on no more than three concrete adjustment rings. Wood or steel shims shall not be used to level the adjustment rings or frames.

.14 New Catch Basin Adjustments:

.1 Place catch basin frame and cover to required elevation on no more than one course of brick (100 mm maximum).

.2 Make brick joints and join brick to frame with non shrink grout as per Section 03300. Parge with non shrink grout and make a smooth watertight finish.

.3 Catch basin frame and cover shall be installed 10 mm below finished surface elevation and 10 mm behind face the face of curb.

.15 Clean manholes and catch basins of debris and foreign materials. Remove fines and sharp projections. Prevent debris from entering system.

.16 Manholes having depth of 6 meters or greater, install safety platforms as indicated.

.17 Where required install Gutter Guard silt protection around catch basins to prevent silt from entering storm system.

3.6 Backfilling and Compaction

.1 Backfill and compact in accordance with Section 03000 – Excavating, Trenching and Backfilling and Section 06000 – Backfill Regulations for Public Right-of-Ways.

End of Section

CAST-IN-PLACE CONCRETE

1. GENERAL

1.1 Description

.1 This Section specifies requirements of the supply and installation for Cast-in-place concrete.

1.2 Related Work

.1 Safety Requirements.....Section 01500

.2 Temporary Fencing.....Section 01520

.3 Excavation, Trenching and Backfilling.....Section 03000

.4 Catch Basin Leads.....Section 03125

.5 Manholes and Catch Basins.....Section 03150

1.3 References

.1 City of Medicine Hat Temporary Traffic Control Manual

.2 CAN/CSA-A23.1-04, Concrete Materials and Methods of Concrete Construction.

.3 CAN/CSA-A23.2-.04, Methods of Test and Standard Practices for Concrete.

.4 CAN/CSA-A3000-08, Portland Cement.

.5 CAN3-A266.1-M78, Air-Entraining Admixtures for Concrete.

.6 CAN3-A266.2-M78, Chemical Admixtures for Concrete.

.7 CAN3-A266.4-M78, Guidelines for the Use of Admixtures in Concrete.

.8 CGSB 51-GP-51M-81, Polyethylene Sheet for Use in Building Construction.

.9 ASTM C109/09M-08, Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 inch or 50 mm Cube Specimens).

.10 ASTM C309-07, Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

.11 CAN/CSA G30.18-M92, Billet Steel Bars for Concrete Reinforcement.

2. PRODUCTS

2.1 Materials

.1 Portland cement: to CAN/CSA-A3000-08, sulphate resistant (Type HS).

.2 Water: to CAN/CSA-A23.1.

.3 Aggregates: to CAN/CSA-A23.1.

.4 Air entraining admixture: to CAN3-A266.1.

.5 Chemical admixtures: to CAN3-A266.2. Engineer to approve accelerating or set retarding admixtures during cold and hot weather placing.

.6 Curing compound: to CAN/CSA-A23.1 white and to ASTM C309-07, Type 1-D with fugitive dye.

.7 Polyethylene file 0.15 mm: to CGSB 51-GP-51M.

.8 Reinforcement for Concrete: CSA G30.18-M92.

.9 Form stripping agent: colourless mineral oil free of kerosene, with viscosity between 15 to 24 mm/s.

2.2 Concrete Mixes

.1 Normal Density Concrete:

.1 Proportion normal density concrete in accordance with CAN/CSA-A23.1-04, to give following properties for all concrete:

.2 Cement: Type HS Portland cement.

.3 Minimum compressive strength at 28 days: 25.0 MPa.

.4 Minimum cement content: 300 kg/m^3 of concrete.

.5 Maximum water cement ration: 0.45

.6 Class of exposure: A.

.7 Nominal size of coarse aggregate: 20 mm.

.8 Slump at time and point of discharge: maximum 65 mm.

.1 No water adjustment is allowed to the delivered concrete after 1 hour of the concrete batch time.

.9 Air content: 5 to 8%.

.2 Non Shrink Concrete (fillcrete):

.1 Compressive Strength of 0.2 MPa to 0.5 MPa.

.2 Maximum compressive strength shall not exceed 0.5 MPa in 56 days.

.3 Cement: Type HS Portland cement.

.4 Slump Requirements:

.1 Minimum Slump – 75 mm.

.2 Maximum Slump – 125 mm.

.5 Admixtures:

.1 Air Entrainment – 5 to 8 %.

.2 Calcium Chloride may be used.

.6 Aggregate Gradation:

SIEVE SIZE	PERCENT PASSING
10 mm	100
5 mm	95 – 100
2.5 mm	80 – 100
1.25 mm	50 – 100
630 um	25 – 65
315 um	10 – 35
160 um	2 – 5
80 um	0 - 10

.3 Non Shrink Grout:

.1 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.

.2 Cement: Type HS Portland Cement.

.4 Dry Pack:

.1 Premixed compound consisting 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 compressive strength of 50 MPa at 28 days.

2.3 Curing Compound

.1 Curing compound shall conform to ASTM C309-07 Type 1-D or 2, and be approved by the Engineer.

.2 The compound shall be sufficiently free from permanent colour to result in no pronounced change in colour from that of natural concrete.

.3 The compound shall, contain a dye of colour strength sufficient to render the film distinctly visible on the concrete for a period of at least four (4) hours after application.

2.4 Sealing Solution

.1 The sealing solution shall be a mixture of 50% boiled linseed oil and 50% kerosene or varsol.

3. EQUIPMENT

3.1 General

.1 All equipment necessary for the proper handling of materials, batching, mixing, placing, finishing and curing of concrete pavement shall be on the project in good working condition. Throughout the construction of the project, the Contractor shall maintain sufficient, adequate equipment in good, clean, working condition, to assure the proper execution of the work.

3.2 Mixing Equipment

.1 Concrete may be mixed at the site of construction, at a central point, or wholly or in part in truck mixers. Each mixer shall be an approved type and shall have attached, prominently, a manufacturer's plate showing the capacity of the drum in terms of volume of mixed concrete and the speed of rotation of the mixing drum or blades.

3.3 Forms

.1 Forms, either of steel or wood shall conform to the shape, lines and dimensions of the concrete as called for on the drawings.

.2 Forms shall be substantial and sufficiently tight to prevent leakage of mortar; they shall be properly braced or tied together so as to maintain position and shape.

.3 The inside of the forms shall be smooth, cleaned and coated with non staining mineral oil or other approved material.

3.4 Additional Equipment

.1 The Contractor shall furnish all other tools and supplies necessary for the proper execution of the Work.

4. EXECUTION

4.1 General

.1 Do cast-in-place concrete work in accordance with CAN/CSA-A23.1-04.

4.2 Safety Requirements

.1 All safety requirements shall be followed as per Section 01500.

4.3 Traffic Control

.1 All traffic control shall be in accordance with the most recent City of Medicine Hat Temporary Traffic Control Manual.

4.4 Certificates

.1 Minimum two weeks prior to starting concrete work, submit to Engineer manufacturers' text data and certification by qualified independent inspection and testing laboratory, that the following materials will meet specified requirements:

.1 Portland Cement.

.2 Admixtures.

.3 Aggregates.

.4 Water.

.2 Provide certification that mix proportions selected will produce concrete of specified quality and yield, that strength will comply with CAN/CSA-A23.1-04, and that mix design is adjusted to prevent alkali aggregate reactivity.

4.5 Testing and Inspection

.1 The Owner may engage a CSA certified testing company to confirm the compliance to the specifications.

.2 The Contractor shall allow access and provide material for all tests by the Owners testing agency.

.3 The testing company is only authorized to report results of the tests and is not authorized to approve the construction. Any questions raised by the testing will be directed to the Owner.

.4 Testing frequencies shall be at 1 test per 50 cubic meters or 1 test per day on placed concrete whichever is greater.

.5 The cost of further testing will be at the expense of the Contractor if the concrete does not meet the specification criteria in the initial tests.

.6 Remedial actions shall be at no expense to the Owner or the Engineer.

4.6 Workmanship

.1 Obtain Engineer's approval before placing concrete. Provide 24 hours notice prior to placing of concrete.

.2 Obtain Engineer’s approval of proposed method for protection of concrete during placing and curing in adverse weather, prior to placing concrete.

.3 Ensure reinforcement and inserts (if required) are not disturbed during concrete placement.

.4 Prior to placing of concrete, obtain Engineer's approval of proposed method for protection of concrete during placing and curing in adverse weather.

.5 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, ambient air temperature and test samples taken.

.6 Do not place load upon new concrete until authorized by Engineer.

4.7 Dowelling

.1 Steel dowels to CSA G30.18-M92, clean, plain, free from flattened or burred ends, free from rust, scale or other substances that prevent the bonding of the concrete to the reinforcement, uncoated.

.2 10 mm steel dowels shall be installed at a minimum of 1 dowel per 0.45m when tying into existing concrete structures.

4.8 Reinforcement

.1 Reinforcing bars, tie bars to CSAG30.18-M92 Grade 400, billet-steel, deformed bars, uncoated.

.2 Place reinforcing bars in lane crossings or as detailed.

.3 Clean reinforcing bars free of loose rust and mill scale.

4.9 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, opening, et., greater than 100 mm X 100 mm not indicated on structural Drawings must be approved by Engineer.

4.10 Delivery

.1 When a truck mixer or agitator is used for transporting concrete, the concrete shall be delivered to the site of the work and discharge shall be completed within one and one-half (1½) hours after the introduction of the mixing water to the cement and aggregates (otherwise known as batch time). If the concrete has not been discharged within one and one-half (1½) hours from batch time, the concrete shall be retested for slump, air and compressive strength. The concrete shall be rejected if any of the mix properties do not conform to the specified requirements.

.2 No water or chemical admixtures shall be added to the concrete mixture after one (1) hour from batch time.

.3 At no time will the concrete be accepted if the discharge has not been completed within two (2) hours from the batch time.

4.11 Placement and Consolidation

.1 All concrete sections to be constructed in accordance with attached detailed drawings.

.2 Placing shall be continuous between planned transverse joints without the use of intermediate bulkheads. If concrete pavement is interrupted for more than 30 minutes, transverse construction joints shall be made.

.3 The concrete shall be placed or subsequently distributed to an even depth.

.4 All concrete construction shall be vibrated by means of a vibrating screed or internally by means of a poker or pencil vibrator which shall not exceed fifty (HS) millimetres in diameter.

4.12 Cold Weather Requirements

.1 Do not place concrete when air temperature is below 5 degrees Celsius, unless the following requirements are met:

.1 Preheat water and aggregates as well as reinforcement, forms and the ground.

.2 Concrete when deposited, shall have a temperature of not less than 4 degrees Celsius or more than 27 degrees Celsius under warm weather conditions. Concrete shall be covered and maintained at a temperature of at least 10 degrees Celsius for not less than seventy two (72) hours after placing, or until the concrete has thoroughly hardened.

.3 Do not use calcium chloride, except with the written permission of the Engineer and then only with normal Portland cement and in quantities less than 2% by weight. Close control of calcium chloride quantities and careful mixing is required.

4.13 Concrete Finishing

.1 After placing, concrete shall be finished as per the relevant sections of Clause 22 of CAN/CSA A23.1-04. Excess finishing is to be avoided. No plaster coat will be allowed. Adding water to the surface of the concrete to assist with finishing will not be allowed.

.2 The Contractor shall always have available material to protect the surface of the plastic concrete from damage from the rain. The materials shall consist of burlap, cotton mats, waterproof paper or plastic sheeting. Protection shall be employed when rain, sufficient to mar the texture of the concrete surface is expected. The decision of the Engineer in this regard shall be final.

.3 The Contractor is responsible to ensure the surface of the concrete is not vandalized during set-up. Any damaged surface must be repaired, or replaced, to the satisfaction of the Engineer.

.4 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.

.5 Broomed Finish:

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

.6 Trowelled Finish:

.1 After completion of floating surface, trowel to produce a dense smooth finish.

.7 Surface Hardener:

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

.8 Curing Compound:

.1 For exposed concrete, a curing compound shall be uniformly sprayed, applied immediately on completion of finishing surface in accordance with manufacturer’s printed instructions.

4.14 Concrete Curing

.1 As soon as practical, after the texturing operation is complete, the entire pavement surface, including exposed sides, shall be cured by protecting it against loss of moisture, rapid temperature change and mechanical injury, in accordance with the requirements of Clause 21 of CSA A23.1-04 for Class C-2 concrete.

.2 The Contractor shall be responsible for taking all necessary measures to protect freshly placed concrete from adverse weather conditions, including hot weather, wind, rain, sleet, snow and cold weather, to the satisfaction of the Engineer. Concrete shall be adequately protected in accordance with the requirements specified in CAN/CSA-A23.1–04, Section 21.2.

.3 When Polyethylene film sheets (light coloured) or waterproof paper sheets are used, the sheets shall be long enough to cover the entire width and edges of the section and shall be lapped a minimum of 300 mm at joints. The sheets shall be adequately weighed to prevent displacement or billowing due to wind.

.4 When white liquid membrane forming curing compounds as per ASTM 309-07 are employed, the compound shall be applied to exposed surface and edge of the concrete section following the final texturing operation, after all free bleed water has evaporated or been removed from the surface. Complete and uniform coverage, at a rate of three (3) to four (4) m²/L shall be required. The compound shall be agitated to prevent pigment from settling.

.5 If the curing compound method of curing is used in combination with sawn control joints, provisions shall be made to cure and protect the exposed faces of the cleaned joint.

.6 When concrete has been placed in cold weather and the air temperature is expected to drop below 5 C, then polyethylene sheets, insulated curing blankets or other suitable material shall be placed beside the concrete members. Whenever the temperature is expected to reach the freezing point, during the day or night, the protective material shall be spread over the concrete surface and weighted to prevent movement to protect the concrete from freezing. Curing shall continue until the cumulative number of days, not necessarily consecutive, or fraction thereof, during which the temperature of the air in contact with the concrete is above 10 C, has totalled a minimum of seven (7) days. Alternatively, if compressive test of cylinders cured under field conditions achieve at least 70 percent (70%) of the specified compressive strength, curing may be discontinued.

.7 Concrete placed in cool weather shall experience a minimum 30 day air drying period, following final curing, before the first application of de-icing salts.

.8 Concrete damaged as a result of inadequate protection against weather conditions, in the sole opinion of the Engineer shall be removed and replaced by the Contractor at his own expense.

5. FINAL INSPECTIONS AND ACCEPTANCE

5.1 Inspection

.1 All workmanship and all materials furnished and supplied under this Specification are subject to close and systematic inspection and testing by the Engineer including all operations from the selection and production of materials through final acceptance of the specified work. The Contractor shall be wholly responsible for the control of all operations incidental thereto notwithstanding any inspection or approval that may have been previously given. The Engineer reserves the right to reject any materials or works which are not in accordance with the requirements of this Specification.

5.2 Access

.1 The Engineer or a designate shall be afforded full access for the inspection and control testing of concrete and constituent materials, both at the site of work and at any plant used for the production of concrete, to determine whether the concrete is being supplied in accordance with this Specification.

5.3 Compressive Strength

.1 Payment adjustments for compressive strength are as follows:

Average Compressive Strength	Payment Adjustment Factor
Compliant or greater	1.00
24.0 MPa to 24.9 MPa	0.95
23.0 MPa to 23.9 MPa	0.90
Below 23.0 MPa	Reject (Note 1)

Note 1: Subject to removal and replacement at the discretion of the Engineer.

5.4 Air Content

.1 Payment adjustments for air content are as follows:

Average Air Content	Payment Adjustment Factor
5% or greater	1.00
4.59% - 4.9%	0.90
4.09% – 4.4%	0.80
Below 4.0%	Reject (Note 1)

Note 1: Subject to removal and replacement at the discretion of the Engineer.

5.5 Final Acceptance

.1 In the event where the compressive strength of the test cylinders, low air entrainment, deficient slump, improper compaction of the concrete base, poor finishing or crossfall, trueness of surfaces, elevation and alignment tolerances for any portion of the work does not meet the requirements specified herein, the City of Medicine Hat and its representatives, at their discretion may require that the portion (s) deemed deficient be completely removed and replaced at the expense of the Contractor.

END OF SECTION

SUB-GRADE PREPARATION

1. GENERAL

1.1 Description

.1 This section refers to the sub-grade construction of the roadways.

.2 Sub-grade construction shall include scarifying, moisture conditioning, compacting and fine grading.

.3 All the above to be carried out in accordance with these specification and the lines, grades and dimensions shown on the drawings.

1.2 Related Work

.1 Section 05140 – Asphalt Concrete

1.3 Definitions

.1 Sub-grade elevation: elevation immediately below the granular sub-base structure.

.2 Asphalt Concrete - Generally refers to the final HMA product in place.

2. PRODUCTS

2.1 Materials

.1 Fill materials require approval by the Engineer.

.2 Fill Material – fill materials, where required, shall be free of stones larger than 150mm, clods, sticks, roots, concrete, any toxic materials (e.g. salt, oil, etc.) and other objects, extraneous matter and debris. These materials shall be removed from the site and disposed of. Disposal locations shall be approved for fill containing any of the above materials by the Engineer.

.3 Imported granular material shall be well graded, select, pit-run or crushed gravel and shall contain no organic or other deleterious substances. It shall be graded as per Clause 2.1 of Section 05020 – Granular Sub-Base.

.4 The synthetic filter fabric shall consist of durable, permeable, woven, polypropylene fabric composed of continuous synthetic filaments with typical properties as follows:

Puncture Strength	420 N
Tensile Grab Strength	890 N
Trapezoidal Tear Strength	400 N
Mullen Burst Strength	2,900 KPa

3. EXECUTION

3.1 Equipment

.1 The Contractor will obtain and review the most recent Temporary Traffic Control Manual available on the City of Medicine Hat website.

.2 Trucks must be loaded in such a manner that no spillage occurs, and care must be taken to prevent dragging construction materials onto improved streets.

.3 Trucks must follow applicable cargo securement requirements as per the Highway Traffic Act.

.4 Haul routes must be kept clear and free from dust by grading and sprinkling with moisture whenever, in the opinion of the Engineer, conditions warrant this treatment.

.5 All excavating and hauling equipment must be equipped with suitable muffling systems.

3.2 Reservation of Material

.1 Whenever gravel, sand, topsoil, or any other material suitable for special use is encountered, it shall be deemed to be the property of the Owner and shall be used as fill or any special purpose, or otherwise disposed of as directed by the Engineer.

.2 Where layers of gravel, or gravely mixtures are encountered they shall be excavated separately from other excavation, and shall be stockpiled, or incorporated into the work as base or sub-base material, or otherwise disposed of as directed by the Engineer.

3.3 Unstable Sub-Grade

.1 Where the subgrade is un-stable, or where it contains materials such as ashes, cinders, refuse, vegetable or organic material, the Contractor shall excavate such material to the width, depth (minimum 300 mm) and length ordered by the Engineer and dispose of the material as directed. The subgrade shall then be made stable by backfilling with approved native material or imported granular material as per Section 05020 Clause 2.1.3. Material shall be placed in successive layers as directed by the Engineer and compacted to a minimum of 98% standard Proctor maximum dry density at ± 2% of the optimum moisture content as determined by ASTM D698.

3.4 Sub-Grade Preparation

.1 The sub-grade shall be scarified to a minimum depth of 150 mm and compacted to a minimum of 98% standard Proctor maximum dry density at +/- 2 % of the optimum moisture content as determined by ASTM D698, over the full width of the cross-section. The material shall be worked to ensure as much uniformity as possible.

.2 Shape and roll alternately to obtain a smooth, even and uniformly compacted sub-grade.

.3 Apply water as necessary during compacting to obtain specified density. If the material is excessively moist, aerate by scarifying with suitable equipment until moisture content is correct.

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

3.5 Allowable Tolerances

.1 The finished subgrade shall be within 30 mm vertically and 150 mm horizontally, but not uniformly high or low.

.2 Correct surface irregularities by loosening and adding or removing material until the surface is within the specified tolerances.

3.6 Testing

.1 The Engineer shall appoint an independent testing consultant to perform all compaction tests for acceptance in accordance with the requirements of this section. Test data provided by this testing agency shall be final and binding on both the Owner and the Contractor.

.2 Density Tests shall be performed at a minimum frequency of 1 Test per 400 square meters.

.3 When required by the Engineer the Contractor shall supply and operate a loaded test vehicle with a minimum of 18,200 Kg. (gross vehicle weight) to test the subgrade for rutting, weaving and soft spots. Where proof rolling indicates areas that are defective, the Contractor shall remove and replace the material with suitable compacted material. Proof rolling shall be considered incidental to the sub-grade construction.

.4 Construction or material not meeting the specifications will not be accepted.

3.7 Maintenance

.1 Maintain finished subgrade in a condition conforming to this section until succeeding material is applied or until acceptance.

END OF SECTION

GRANULAR BASE/SUB-BASE PREPARATION

1. GENERAL

1.1 Description

.1 This section specifies requirements for supply, producing, hauling, placing and compacting processed gravel or quarried stone as a granular base or sub-base to lines, grade and typical cross sections, or as otherwise directed.

.2 Granular Sub-base is defined as the initial layer of granular material placed upon prepared sub-grade to form an integral part of the total pavement structure.

.3 Granular base is defined as the layer of granular material placed upon the compacted granular sub-base or prepared sub-grade to form an integral part of the total pavement structure.

1.2 Related Work

.1 Sub-grade Preparation - Section 05010

.2 Asphalt Prime – Section 05110

.3 Asphalt Concrete - Section 05140

1.3 Samples

.1 At least 2 weeks prior to commencing work, inform the Engineer or their designated representative, of the proposed source of aggregates and provide access for sampling.

1.4 Materials Certification

.1 Aggregates: At least two (2) weeks prior to commencing work provide:

.1 Test data reports representing granular base and/or granular sub-base processed into stockpile. Submit one complete aggregate gradation analysis report for every 1000 tonnes of each material required for the project, or one complete analysis for each production day when production rate is less than 1000 tonnes. Include percentage of crushed coarse aggregate particles in granular base reports.

.2 Certification that the physical properties of the aggregates meet the requirement of this section.

.1 Reports and certification shall be provided by an independent testing consultant under the signature and professional seal of a qualified materials engineer.

.2 At least two (2) weeks prior to contemplated change in source of aggregates, provide written notification to the Engineer and provide new materials certification in accordance with the requirements of this section.

1.5 Submissions

.1 Granular sub-base and base sources and test results shall be submitted to the Engineer for review and approval before being used.

.2 Preliminary review of the material as represented by the test results shall not constitute general acceptance of all the material in the deposit or source of supply. Materials may be considered unsuitable even though particle sizes are within the limits of gradation sizes required, if particle shapes are thin or elongated or any other characteristic precludes satisfactory compaction, or if the material fails to provide a roadway suitable for traffic. Rejected material will not be paid for. The Engineer has the right to request additional testing if there are any concerns with the proposed aggregate.

1.6 Delivery and Storage

.1 Deliver and stockpile aggregates in accordance with the requirements of this section.

.2 Stockpile minimum of fifty (50%) percent of each type of base material required before commencing to haul products to the project site.

.3 Handle and transport products to avoid segregation, contamination and degradation.

.4 Stockpile products in sufficient quantities to meet project schedules. When adding new products to the stockpile after removal to the project site has commenced, do not deposit material against working face of stockpile.

.5 Separate product stockpiles 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 by the Engineer within 48 hours of rejection.

.7 Construct stockpiles in uniform lifts using trucks or rubber-tired loading equipment, being careful to avoid spillage of materials over the ends of previously place lifts. Do not use conveyors or tracked equipment in stockpile construction.

.8 Provide a previously stabilized stockpile base or provide a compacted sand base not less than 300 mm in depth to prevent contamination. Alternatively, stockpile aggregates on the ground but do not incorporate bottom 300mm of pile into the work.

2. PRODUCTS

2.1 Granular Sub-base

.1 Crushed stone or gravel consisting of hard, durable particles free from clay lumps, cementation, organic material, frozen material and other deleterious material.

.2 Physical properties of aggregates:

Los Angeles Abrasion, Loss, %	50 max.
Liquid Limit, %	25 max.
Plasticity Index, %	6 max.
Lightweight particles, %	5 max.
California Bearing Ratio when compacted to 100 % of ASTM D698	20 min.
Crushed Particles (1 face, plus 5 000 sieve fraction) , %	50 min.

.3 Gradation to be within the following limits when tested to ASTM C-136 and ASTM C-117 with sieve sizes to CAN/CGSBD 8-GP-2M rather than ASTM E11, and to have a smooth curve without sharp breaks when plotted on a semi-log grading chart.

Sieve Size (microns)	Percent Passing By Weight
50 000	100
25 000	66 – 90
16 000	54 – 81
10 000	45 – 73
5 000	35 – 63
1 250	22 – 45
630	17 – 38
315	13 – 30
160	9 – 20
80	4 – 10

2.2 Granular Base

.1 Crushed stone or gravel consisting of hard, durable, angular particles, free from clay lumps, cementation, organic material, frozen material and other deleterious materials.

.2 Physical properties of Aggregates:

% Fracture, by weight (2 faces)	60 min.
Los Angeles Abrasion, loss, %	45 max.
Liquid Limit, %	25 max.
Plasticity Index, %	6 max.
Lightweight particles, %	5 max.
California Bearing Ratio, when compacted to 100% of ASTM D698	80 min.

.3 Gradation to be within the following limits when tested to ASTM C-136 and ASTM C-117 with sieve sizes to CAN/CGSB 8.2-M88 and to have a smooth curve without sharp breaks when plotted on a semi-log grading chart.

Sieve Size (microns)	Percent Passing By Weight
20 000	100
16 000	84 - 94
10 000	63 – 86
5 000	40 – 67
1 250	20 – 43
630	14 – 34
315	9 – 26
160	5 – 18
80	2 - 10

3. EXECUTION

3.1 General

.1 The subgrade shall be prepared according to the requirements of Section 05010, Subgrade Preparation, and to cross-sections shown on the Drawings. The Contractor shall maintain the subgrade to the specified section, free from ruts, waves and undulations until granular sub-base material is placed. The subgrade shall be in a firm dry condition and must be approved by the Engineer before gravel is placed. The depositing of granular base or sub-base on a soft, muddy or rutted subgrade will not be permitted.

3.2 Placing

.1 Place material only on a clean unfrozen surface, properly shaped and compacted and free from snow and ice.

.2 Place using methods which do not lead to segregation or degradation of Aggregate. Use approved methods to create uniform windrow of material along a crown line or high side of a one-way slope.

.3 Place material to full width in layers not exceeding 150 mm in compacted thickness.

.4 Shape each layer to a smooth contour and compact to the specified density before a succeeding layer is placed.

.5 Apply water as necessary during compacting to obtain specified density. If the material is excessively moist, aerate by scarifying with suitable equipment until moisture content is correct.

.6 Remove and replace any portion of a layer in which material becomes segregated during compaction.

3.3 Compacting

.1 The granular base and sub-base shall be compacted to a density not less than 100% of standard Proctor maximum dry density at +/-2 % of the optimum moisture

content as determined by ASTM D698 (Method C) over the full width of the cross section.

.2 Shape and compact alternately to obtain a smooth, even and uniformly compacted base and sub-base.

.3 Apply water as necessary during compacting to obtain specified density. If the material is excessively moist, aerate by scarifying with suitable equipment until moisture content is correct.

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

3.4 Allowable Tolerances

.1 Finished sub-base and base surfaces shall be within plus or minus 10 mm of established grade, but not uniformly high or low.

.2 Correct surface irregularities by loosening and adding or removing materials until surface is within the specified tolerances.

3.5 Testing

.1 The Engineer shall appoint an independent testing consultant to perform all compaction tests for acceptance in accordance with the requirements of this section. Test data provided by this testing agency shall be final and binding on both the Owner and the Contractor.

.2 Density Tests shall be generally performed at a minimum frequency of 1 Test per 400 square meters.

.3 When required by the Engineer the Contractor shall supply and operate a loaded test vehicle with a minimum of 18,200 Kg. (gross vehicle weight) to test the granular materials for rutting, weaving and soft spots. Where proof rolling indicates areas that are defective, the Contractor shall remove and replace the material with suitable compacted material. Proof rolling shall be considered incidental to the sub-base and base construction.

.4 Construction or material not meeting the specifications will not be accepted.

3.6 Maintenance

.1 Maintain finished sub-base and base surfaces in a condition conforming to this section until succeeding material is applied or until acceptance.

END OF SECTION

PRIME, TACK, AND FOG COATS

1. GENERAL

1.1 Description

.1 This section specifies the requirements for low-viscosity bituminous materials (emulsified asphalt) to be used in prime coats, tack coats, and fog coats, as well as associated materials.

.2 The Work consists of supplying emulsified asphalt including ordering, scheduling, delivery, storage facilities, handling, storing, sampling, testing, placement of the emulsified asphalt on the required locations or as directed in writing by the Project Engineer, and other related items.

1.2 Related Sections

.1 Hot Mix Asphalt Concrete – Section 05140.

.2 Hot Mix Asphalt Concrete Trails – Section 05150.

1.3 Definitions

.1 Acceptance is the process undertaken by the Engineer in which the available Quality Control and Quality Assurance test data is reviewed and the Work is inspected by Project Engineer to ensure that it meets the requirements of the specifications. Recommendation for acceptance may be provided by Project Engineer.

.2 Contractor is the Party that enters into an agreement to provide the required materials and to perform the Work on the project at a predetermined price or rate.

.3 Emulsified asphalt is a suspension of minute globules of asphalt binder in water that contains a small amount of emulsifying agent.

.4 Engineer as referred to in this specification, shall be Engineering Manager Municipal Works Department, City of Medicine Hat or designated representative.

.5 Fog coat is an application of emulsified asphalt to seal small cracks and surface voids in existing Hot Mix Asphalt (HMA) concrete to inhibit ravelling and / or the ingress of moisture. A fog coat will only be required if, in the written opinion of the Engineer, the HMA concrete is open in texture/segregated and/or contains small surface cracks.

.6 Prime coat is an application of emulsified asphalt which is designed to penetrate, bond, and stabilize a previously prepared granular base course or an existing absorbent surface, preparatory to placing bituminous surfacing materials or HMA concrete and is intended to promote bonding between the 2 differing materials.

.7 Project Engineer shall be City Engineer or designated representative or shall mean the licensed professional Engineer retained by the Developer.

.8 Quality Assurance (QA) is the planned and systematic activities, on the part of a purchaser or owner, implemented in a quality system so that the quality requirements for a material, product or service are verified or confirmed.

.9 Quality Control (QC) is the operational techniques and activities, on the part of a material, product or service provider, used to achieve and maintain the material, product or service to the required quality.

.10 Sand blotter is the application of clean granular material used to absorb excess emulsified asphalt, which has failed to penetrate into the granular base course or ponded on other surfaces.

.11 Tack coat is an application of emulsified asphalt to a previously constructed paved surface of any type or age in preparation for placing a new layer of HMA concrete and is intended to provide a thorough bond between the old and new materials.

2. PRODUCTS

All emulsified asphalts must be homogeneous and uniform in character throughout and meet the requirements indicated in the current edition of Alberta Transportation's Standard Specification for Highway Construction, Section 5.7 Supply of Asphalt, Table ASPH-7 Specifications for Anionic Emulsified Asphalts. In the case of a discrepancy between this specification and Section 5.7 Supply of Asphalt this section will govern.

2.1 Prime Coat

.1 The emulsified asphalt must be a Slow Setting (SS) type SS-1 diluted at a maximum of 1 part potable water added to 1 part SS-1 up to September 30. After September 30 the Contractor may use an undiluted Medium Setting (MS) type MS-1 or a Rapid Setting (RS) type RS-1.

2.2 Tack Coat

.1 The emulsified asphalt type must be a SS-1 diluted at a maximum of 1 part potable water added to 1 part SS-1 up to September 30. After September 30 the Contractor may use an undiluted Rapid Setting (RS) type RS-1.

2.3 Fog Coat

.1 The emulsified asphalt type may be a SS-1 or a MS-1 depending on the surface material to be sealed.

2.4 Sand Blotter

.1 The materials for sand cover used to blot excessive emulsified asphalt must consist of clean granular aggregate material, all of which must pass a 5 000 µm sieve, be free from organic matter or other deleterious materials, and approved in writing for use by the Project Engineer.

2.5 Materials Certification

.1 At least 3 weeks prior to commencing Work on the project, the Contractor shall submit written and signed certification, from the emulsified asphalt supplier, to the Project Engineer, that the emulsified asphalt complies with these specifications. This certification must include but is not limited to:

.1 Name of the emulsified asphalt supplier.

.2 Source(s) of the base asphalt binder(s).

.3 Current laboratory test results for the emulsified asphalt.

2.6 Sampling and Testing

.1 All emulsified asphalt may be subject to inspection, sampling, and testing by the Project Engineer.

.2 Upon written request by the Project Engineer submit supplier's most recent test data indicating that the emulsified asphalt meets requirements of this specification and the current edition of Alberta Transportation's Standard Specification for Highway Construction, Section 5.7 Supply of Asphalt, Table ASPH-7 Specifications for Anionic Emulsified Asphalts.

.3 The Contractor must obtain representative, uncontaminated samples of each type of the emulsified asphalt delivered for use on the project for QA testing. Samples must be obtained once from every 500 tonnes of each type of emulsified asphalt delivered for use on the project. At least 1 sample of each type of emulsified asphalt must be obtained for each project, regardless of project size, unless directed otherwise, in writing by the Project Engineer.

.4 The QA samples must be appropriately labelled in order to identify the Contractor, emulsified asphalt supplier, project, date and time sampled, type of emulsified asphalt, and the weigh bill number of the load sampled.

2.7 Quality Control

.1 The Contractor must have monitoring procedures in-place to provide daily "bulk" measurements of emulsified asphalt and potable water, as applicable, to verify that the maximum dilution rates indicated in 2.1.1 and 2.2.1 are not exceeded. If requested in writing by the Project Engineer, the Contractor must provide the daily bulk quantity checks within 1 working day of the HMA being placed on the project.

2.8 Quality Assurance

.1 The Contractor must deliver the QA samples to the Project Engineer within 1 working day after they were obtained.

.2 The Project Engineer may test random QA samples. If a tested sample indicates non-compliant emulsified asphalt, testing will occur on the QA sample taken immediately prior to and immediately after the non-compliant sample.

.3 Acceptance or rejection of the emulsified asphalt will be based on the test results.

3. EXECUTION

3.1 Delivery and Storage

.1 All emulsified asphalt storage facilities must be equipped with sampling valves maintained in good operating condition which are designed and located to enable representative sampling into the appropriate 1 or 2 litre containers of the emulsified asphalt. The Contractor must provide safe, convenient access, acceptable to the Project Engineer, for inspection and sampling of the emulsified asphalt, and must cooperate in the inspection and sampling process when requested to do so.

.2 The Contractor must follow the supplier's specified handling and storage requirements for each type of emulsified asphalt. All asphalt emulsions must be protected from freezing.

.3 The Contractor must prevent contamination of the emulsified asphalt, by emulsified asphalt of another type, by solvent, or by any other material.

.4 No emulsified asphalt type must be diluted or mixed with a different type, or with any other material, without the specific written approval of the Project Engineer.

.5 Emulsified asphalt storage tanks must be emptied of one type of emulsified asphalt, and cleaned as necessary to prevent detrimental contamination of the emulsified asphalt, before placing another type of emulsified asphalt therein.

.6 Provide to the Project Engineer, upon written request, all freight and weight bills / bill of lading for emulsified asphalt binder received.

3.2 Equipment

.1 Pressure Distributor:

.1 Designed, equipped, maintained, and operated so that the emulsified asphalt materials can be heated to a uniform temperature and can be applied uniformly on variable widths of surface up to 5 metres. The application rate must be readily determined and controlled at rates from 0.2 to 5.0 litres/square metre (L/m^2) and with an allowable variation from any specified rate not exceeding 0.1 L/m^2.

.2 Capable of distributing emulsified asphalt material from a spray bar in a pressurized, uniform spray without atomization at the temperature required. The spray patterns made by the nozzles must result in overlap so that 3 nozzles cover any given area (except the 2 nozzles at the very end of the spray bar) to avoid streaking. Nozzles must be of the same manufacture, size, type, and must be set in the spray bar so that all nozzle slots make the same angle with the longitudinal axis of the spray bar.

.3 Capable of maintaining the spray bar, at a constant height for uniform application of the emulsified asphalt, as material is withdrawn from the reservoir tank.

.4 Equipped with a meter registering lineal metres per minute visibly located to enable the operator to maintain constant speed required for application at specified rates.

.5 Has a positive displacement pump equipped with flow meter registering litres per minute passing through the nozzles and visible to the operator of the distributor. The pump must operate by a hydraulic motor powered by the truck power unit or by a separate independent power unit.

.6 Equipped with an easily read, accurate, and sensitive device, which registers the temperature of the emulsified asphalt in the reservoir tank.

.7 Equipped with accurate volume measuring device or calibrated tank.

.8 Equipped with heating attachments and circulation or agitation capability.

.9 Has a pressurized hand wand that can be used to treat areas not readily accessible by the spray bar.

.10 Has a positive shut-off valve to prevent dripping from the spray bar or hand wand.

3.3 Application

.1 Before application of the emulsified asphalt all loose, dirty or objectionable material must be removed from the surface by power brooming or by other methods acceptable

to the Project Engineer. Obtain Project Engineer 's written approval of existing surface before applying any emulsified asphalt.

.2 Temperature of the emulsified asphalt is to be between 20°C and 60°C in the reservoir tank prior to application.

.3 Upon the prepared and approved surface, the emulsified asphalt must be applied uniformly without streaking at a rate of: from 0.50 to 3.00 L/m^2 for prime coats; from 0.20 to 0.90 L/m^2 for tack coats; from 0.20 to 0.60 L/m^2 for fog coats; or as directed in writing by the Project Engineer.

.4 The emulsified asphalt must be uniformly applied and without streaking or ponding. Joints and seams must not be excessively overlapped. Correct all areas that have not received sufficient coverage or have been damaged by traffic with the additional application of emulsified asphalt, to the written satisfaction of the Project Engineer. Immediately correct all areas of ponding or excessive emulsified asphalt by an application of a sand blotter, removal by squeegeeing or scraping, rolling with a pneumatic tired roller or other means, to the written satisfaction of the Project Engineer. If the emulsified asphalt has set remove excess material by cold milling or other means, to the written satisfaction of the Project Engineer.

.5 Where traffic is to be maintained treat no more than 1/2 of the roadway surface at a time with emulsified asphalt.

.6 Cover all contact surfaces of curbs, gutters, headers, manholes, water valves, and like appurtenances with a uniform coat of the same emulsified asphalt material.

.7 Do not apply emulsified asphalt when rain is forecast within 2 hours, the weather is foggy, excessively windy or when the air temperature is less than 5°C, unless otherwise permitted in writing by the Project Engineer.

.8 All areas and structures adjacent to the roadway must be completely protected from the emulsified asphalt application operation including any accidental spillage of emulsified asphalt. Any unnecessary spraying or splashing by emulsified asphalt of areas adjacent to the roadway Work that will be visible when placement of the HMA concrete is complete must be cleaned to the written approval of the Project Engineer. All costs related to cleaning these areas will be borne solely by the Contractor.

.9 Traffic must not be permitted to travel on the prime coat until at least 6 hours after application or until it has completely cured. The Contractor must maintain the prime coat surface until the HMA concrete has been place on it. Maintenance must include spreading any additional sand blotter and patching any breaks in the prime coat surface with additional emulsified asphalt.

.10 Preferably, the emulsified asphalt prime coat should be entirely absorbed by the granular base course and therefore require no sand cover. However, if the emulsified asphalt has not been completely absorbed 6 hours after application, just sufficient sand blotter must be spread over the surface to blot up the excess emulsified asphalt and prevent it from being picked up by any traffic.

.11 Traffic must not be permitted to travel on the tack coat or fog coat until they are completely cured. The Contractor must use flagmen, if required, and signage to control traffic until the tack coat or fog coat has completely cured.

3.4 Acceptance

.1 The Contractor must provide emulsified asphalt, prime coats, tack coats, and fog coats conforming to the requirements of this specification and to workmanship in accordance with industry standards.

.2 If non-compliant emulsified asphalt is identified by the Engineer, use of the non-compliant emulsified asphalt must be suspended until the Contractor, Project Engineer and Engineer can determine the impact of the non-compliance and what the necessary remedial actions to be taken by the Contractor will be. Remedial actions must be either acceptance at full payment, acceptance at a payment adjustment or rejection.

.3 If the Contractor, Project Engineer and Engineer cannot agree on an acceptable payment adjustment for the HMA concrete affected by the non-compliant emulsified asphalt the Contractor, Project Engineer and the Engineer will jointly hire an independent third party to determine the payment adjustment.

.4 If, in the written opinion of the Engineer, any emulsified asphalt that fails to meet the required specifications is significant enough to result in the probable unsatisfactory performance of the HMA concrete affected by the non-compliant emulsified asphalt, it will be rejected. The Contractor must remove and replace all the HMA concrete placed on the failed emulsified asphalt. Removal and replacement of the rejected HMA concrete must be at the Contractor's cost. If the Contractor disagrees and submits in writing to the Engineer within 3 working days of receipt of notice from the Engineer that the HMA concrete is rejected, the Contractor, Project Engineer and the Engineer will jointly hire an independent third party to determine if the non-compliant emulsified asphalt will result in the probable unsatisfactory performance of the HMA concrete and its subsequent rejection.

.5 If the Contractor, Project Engineer and the Engineer cannot agree on an independent third party, the Contractor and Engineer will each nominate an independent third party to a Panel and those two parties will select an independent third party to act as the chair of the Panel. The Panel will then determine the payment adjustment or if the HMA concrete should be rejected.

.6 All costs for the independent third party or the Panel will be split evenly between the Contractor and the Project Engineer.

.7 If suspended, the paving program must only recommence upon written authorization of the Engineer.

.8 Acceptance in writing by the Engineer will only occur if there are no obvious defects just prior to the placement of HMA concrete in the case of prime coats and tack coats and upon complete curing in the case of fog coats. In addition, the required QA samples have been provided to the Engineer within the time frame specified.

4. MEASUREMENT AND PAYMENT

.1 Where the contract does not contain a separate bid item for emulsified asphalt, all costs associated with the supply, application, and maintenance of emulsified asphalt must be included in the unit price per tonne of granular base in the case of prime coats and in the unit price per tonne of HMA concrete in the case of tack coats and fog coats and no separate or additional payment will be made.

Where the contract contains a separate bid item for the supply, application, and maintenance of emulsified asphalt measurement will be made by the square metre of treated area regardless of the number of applications of emulsified asphalt.

.2 The supply and application of blotting sand, where required, will be considered incidental to the Work, and no separate or additional payment will be made.

END OF SECTION

ASPHALT BINDER

1. GENERAL

1.1 Description

.1 This section specifies the requirements for asphalt binder to be used in producing Hot Mix Asphalt (HMA) concrete paving mixtures.

.2 The Work consists of supplying asphalt binder including ordering, scheduling, delivery, storage facilities, handling, storing, sampling, testing, and other related items.

.3 When a penetration-viscosity grade asphalt binder is designated for use in the contract, this specification will apply rather than Section 05135 Performance Graded Asphalt Binder.

1.2 Related Sections

.1 Performance Graded Asphalt Binder – Section 05135.

.2 Hot Mix Asphalt Concrete – Section 05140.

.3 Hot Mix Asphalt Concrete Trails – Section 05150.

1.3 Definitions

.1 Acceptance is the process undertaken by the Engineer in which the available Quality Control and Quality Assurance test data is reviewed and the Work is inspected by Project Engineer to ensure that it meets the requirements of the specifications. Recommendation for acceptance may be provided by Project Engineer.

.2 Asphalt binder is a dark brown to black cement like residuum in which the predominating constituent is bitumen obtained from the distillation, with or without additional processing, of a suitable petroleum crude oil. Reference to asphalt binder within this specification includes virgin asphalt binder and asphalt binder / liquid anti-stripping agent combinations, as the case may be.

.3 Contractor is the Party that enters into an agreement to provide the required materials and to perform the Work on the project at a predetermined price or rate.

.4 Engineer as referred to in this specification, shall be Engineering Manager Municipal Works Department, City of Medicine Hat or designated representative.

.5 Project Engineer shall be City Engineer or designated representative or shall mean the licensed professional Engineer retained by the Developer.

.6 Quality Assurance (QA) is the planned and systematic activities, on the part of a purchaser or owner, implemented in a quality system so that the quality requirements for a material, product or service are verified or confirmed.

.7 Quality Control (QC) is the operational techniques and activities, on the part of a material, product or service provider, used to achieve and maintain the material, product or service to the required quality.

2. PRODUCTS

2.1 Asphalt Binder

.1 The Contractor must supply the types and grades of asphalt binder as specified in the contract.

.2 The asphalt binder must meet the requirements of this specification and the requirements of Alberta Transportation's August 2013, Edition 15, Standard Specification for Highway Construction, Section 5.7 Supply of Asphalt. In the case of a discrepancy between this specification and Section 5.7 Supply of Asphalt this specification will govern.

.3 All asphalt binders must be prepared from the refining of petroleum crude oil in a straight run refining process with no air blowing or the addition of chemical agents. Asphalt binders must be uniform in character, must be free from impurities, and must not foam when heated to 175°C.

.4 Re-refined Engine Oil Bottoms (REOB), also known as Vacuum Tower Asphalt Extenders (VTAE) must not be added, in any proportion, to the asphalt binder. The Project Engineer may perform period chemical analysis to determine if REOB / VTAE has been used.

.5 The Contractor may be required to use more than one type or grade of asphalt binder for a particular purpose on a project. The Engineer must approve in writing any change in asphalt binder type or grade prior to the change being made by the Contractor.

.6 Liquid anti-stripping agents, listed in the most current edition of the Alberta Transportation Products List, may be added to the asphalt binder at a rate not to exceed 0.5% by weight of virgin asphalt binder. The asphalt binder / liquid anti-stripping agent combination must meet the asphalt binder requirements of this specification. Liquid anti-stripping addition rates greater than 0.5% by weight of virgin asphalt binder will only be allowed if the Contractor completes laboratory testing to confirm that the treated virgin asphalt binder meets the requirements of this specification and receives written approval from the Engineer.

.7 The Engineer may consider the use of a liquid anti-stripping agent that is not in the most current Alberta Transportation Products List at the written request of the Contractor. The Contractor must provide sufficient time and all the supporting documentation on the use and long-term performance of the proposed anti-stripping agent required by the Engineer to make a written determination on its use.

.8 The Contractor may use hydrated lime at an additive rate as determined by the HMA mix design but the additive rate must be at least 1.4% by weight of dry aggregate, in place of a liquid anti-stripping agent. The hydrated lime must meet the requirements of AASHTO M303, Lime for Asphalt Mixtures. The Contractor must include the details of the proposed procedures for uniformly incorporating the hydrated lime into the asphalt mix as part of the HMA mix design submission.

2.2 Materials Certification

.1 At least 3 weeks prior to commencing Work on the project submit written and signed certification, from the asphalt binder manufacturer, that the asphalt binder complies with these specifications. This certification must include but is not limited to:

- .1 Name of the asphalt binder manufacturer.
- .2 Source(s) of the base asphalt binder(s).
- .3 Type and source(s) of additives.
- .4 Current laboratory test results for the asphalt binder.
- .5 A certification statement that the asphalt binder is a straight run, non-air blown/oxidized, non-chemically modified asphalt binder and, if the asphalt binder is modified, it has only been modified with Styrene Butadiene (SB) or Styrene Butadiene Styrene (SBS) type copolymers.

.2 At least 10 working days prior to commencing HMA production submit a current temperature-viscosity chart for each required asphalt binder showing the Kinematic Viscosity in mm^2 per second (centistoke) over a temperature range of at least 105°C to 175°C that indicates the recommended mixing and compaction temperatures for the asphalt binder. This submission is to be included as part of the HMA mix design submission.

2.3 Sampling and Testing

.1 All asphalt binder may be subject to inspection, sampling, and testing by the Project Engineer.

.2 Upon written request by the Project Engineer, submit the manufacturer's most recent test data indicating that the asphalt binder meets requirements of this specification and Alberta Transportation's August 2013, Edition 15, Standard Specification for Highway Construction, Section 5.7 Supply of Asphalt.

.3 The Contractor must obtain representative, uncontaminated samples of each type and grade of the asphalt binder delivered for use on the project for QA testing. Samples must be obtained once from every 1,500 tonnes of asphalt binder delivered to the asphalt binder storage facility. At least 1 sample of each type of asphalt binder must be obtained for each project, regardless of project size, unless directed otherwise, in writing by the Engineer.

.4 The QA samples must be appropriately labelled in order to identify the Contractor, asphalt binder supplier, date and time sampled, type and grade of asphalt binder, type and amount of any liquid anti-stripping agent, and the weigh bill number of the load sampled.

.5 The Contractor must supply a weight scale that must be inspected and certified by an Authorized Service Provider recognized by Measurement Canada, an agency of Innovation, Science and Economic Development Canada, at the Contractors' expense prior to the start of the supply of asphalt binder and as often thereafter, as the Project Engineer may direct in writing.

2.4 Quality Control

.1 The Contractor must have monitoring procedures in-place to provide daily "bulk" measurements of all materials used to produce HMA at the asphalt plant including; anti-stripping agents, hydrated lime, and any other additives, as applicable, to verify that usage quantities match targeted values. If requested in writing by the Project Engineer, the Contractor must provide the daily bulk quantity checks within 1 working day of the HMA being placed on the project.

2.5 Quality Assurance

.1 The Contractor must deliver QA samples to the Project Engineer within 1 working day after they were obtained.

.2 The Project Engineer may test random QA samples. If a tested sample indicates non-compliant asphalt binder the QA sample immediately prior and immediately after will also be tested.

.3 Acceptance or rejection of the asphalt binder will be based on the test results.

3. EXECUTION

3.1 Delivery and Storage

.1 Provide storage facilities capable of heating the asphalt binder under effective and positive control at all times. All asphalt binder storage facilities must be equipped with sampling valves maintained in good operating condition which are designed and locate to enable safe, representative sampling into the appropriate 1 or 2 litre containers of the asphalt binder. The Contractor must provide safe, convenient access, acceptable to the Project Engineer, for inspection and sampling of the asphalt binder, and must cooperate in the inspection and sampling process when requested to do so.

.2 The Contractor must follow the manufacture's specified handling and storage requirements for each grade of asphalt binder.

.3 The Contractor must prevent contamination of the asphalt binder, by asphalt binder of another type or grade, by solvent, or by any other material.

.4 No asphalt binder type or grade must be diluted or mixed with a different type or grade, or with any other material, without the specific written approval of the Engineer.

.5 Asphalt binder storage tanks must be emptied of one type or grade of asphalt binder, and cleaned as necessary to prevent detrimental contamination of the asphalt binder, before placing another type or grade of asphalt binder therein.

.6 When a liquid anti-stripping agent is added by the asphalt binder supplier the type and percentage of liquid anti-stripping agent must be listed on each asphalt binder delivery weigh bill.

.7 When a liquid anti-stripping agent is added at the HMA mixing plant the Contractor must provide documentation from the asphalt binder manufacturer that the proposed liquid anti-stripping agent is compatible with the asphalt crude source and asphalt binder grade contained in the mix design when added within the dosage range recommended by the additive supplier.

.8 When liquid anti-stripping agent is added to the asphalt binder at the HMA mixing plant, the liquid anti-stripping agent must be introduced through a separate, calibrated pumping and metering system electronically interlocked with the operating controls of the mixing plant. The calibrated pumping and metering system must have a totalizing flow meter in order to monitor the amount of liquid anti-stripping agent being used on the project. The Contractor must have a procedure in-place enabling the safe sampling of treated asphalt binder including an in-line valve and sampling system.

.9 If hydrated lime is used in place of a liquid anti-stripping agent the feed system must be calibrated to provide a consistent and accurate feed of dry hydrated lime into the mixing plant prior to the asphalt binder injection point. The hydrated lime feed system shall be synchronized to the rate of aggregate feed and must be electronically interlocked with the operating controls of the mixing plant.

.10 The Contractor must provide, maintain and reclaim asphalt binder storage facilities.

.11 Provide to the Project Engineer, upon written request, all freight and weight bills/bill of lading for asphalt binder, liquid anti-stripping agent, and hydrated lime shipments received.

3.2 Acceptance

.1 Asphalt binder supplied and incorporated into the project will be considered for acceptance provided the required QA samples have been provided to the Project Engineer within the time frame specified and where the both the asphalt binder and the HMA in which the asphalt binder was used meet the requirements of the specifications.

.2 If non-compliant asphalt binder is identified by the Engineer, the field placement of the HMA containing the non-compliant asphalt binder must be suspended until the Contractor, Project Engineer and Engineer can determine the impact of the non-compliance and what the necessary remedial actions to be taken by the Contractor will be. Remedial actions must be either acceptance at full payment, acceptance at a payment adjustment or rejection.

.3 If the Contractor, Project Engineer and Engineer cannot agree on an acceptable payment adjustment for the HMA, which contains the non-compliant asphalt binder, the Contractor, Project Engineer and the Engineer will jointly hire an independent third party to determine the payment adjustment.

.4 If, in the written opinion of the Engineer, any asphalt binder that fails to meet the required specifications is significant enough to result in the probable unsatisfactory performance of the HMA concrete in which the asphalt binder was used, it will be rejected. The Contractor must remove and replace all the HMA concrete containing the failed asphalt binder. Removal and replacement of the rejected asphalt binder and HMA concrete must be at the Contractor's cost. If the Contractor disagrees and submits in writing to the Engineer within 3 working days of receipt of notice from the Engineer that the HMA concrete is rejected, the Contractor, Project Engineer and the Engineer will jointly hire an independent third party to determine if the non-compliant asphalt binder will result in the probable unsatisfactory performance of the HMA concrete and its subsequent rejection.

.5 If the Contractor, Project Engineer and the Engineer cannot agree on an independent third party, the Contractor, Project Engineer and Engineer will each nominate an independent third party to a Panel and those parties will select an independent third party to act as the chair of the Panel. The Panel will then determine the payment adjustment or if the HMA concrete should be rejected.

.6 All costs for any independent third party or the Panel will be split evenly between the Contractor and the Project Engineer.

.7 If suspended, the paving program must only recommence upon written authorization of the Engineer.

4. MEASUREMENT AND PAYMENT

.1 If the contract indicates a bid item for the supply of asphalt binder, measurement will be based on weigh bills provided by the manufacturer to the Contractor.

.2 The Project Engineer may confirm delivery quantities by weighing the delivery vehicles before and after unloading.

.3 If there is a discrepancy between the confirmed delivery weight and the manufacturer's weight bill, the confirmed delivery weight will be used.

.4 When the contract contains a bid item for the supply of asphalt binder, payment for the accepted asphalt binder, utilized as per the project requirements, must be at the applicable unit price per tonne in the contract documents.

.5 Where the contract does not contain a bid item for the supply of asphalt binder, accepted asphalt binder will not be paid for as a separate item. Payment for the asphalt binder is then considered to be included in the unit price bid for the contract item in which the asphalt binder was used.

.6 All costs associated with the supply and incorporation of any anti-stripping agent regardless of whether the anti-stripping agent is incorporated by the asphalt supplier or the Contractor, must be included in the unit price bid for supply of asphalt binder (if there is one) or for the unit price bid for the contract item in which the asphalt binder and anti-stripping agent is to be used. No separate or additional payment will be made for the addition of an anti-stripping agent.

.7 Payment will be the full compensation for supplying asphalt binder and anti-stripping agent, if required, to the project including ordering, scheduling, delivery, storage facilities, handling, storing, sampling, testing, and other related items.

END OF SECTION

PERFORMANCE GRADED ASPHALT BINDER

1. GENERAL

1.1 Description

.1 This section specifies requirements for Performance Graded (PG) asphalt binder utilized in Hot Mix Asphalt (HMA) concrete paving mixtures.

.2 The Work consists of supplying PG asphalt binder including ordering, scheduling, delivery, storage facilities, handling, storing, sampling, testing, and other related items.

.3 When a PG asphalt binder is designated for use in the contract, this specification will apply rather than Section 05130 Asphalt Binder.

1.2 Related Sections

.1 Asphalt Binder – Section 05130.

.2 Hot Mix Asphalt Concrete – Section 05140.

.3 Hot Mix Asphalt Concrete Trails – Section 05150.

1.3 Definitions

.1 Acceptance is the process undertaken by the Engineer in which the available Quality Control and Quality Assurance test data is reviewed and the Work is inspected by Project Engineer to ensure that it meets the requirements of the specifications. Recommendation for acceptance may be provided by Project Engineer.

.2 Asphalt binder is a dark brown to black cement like residuum in which the predominating constituent is bitumen obtained from the distillation, with or without additional processing, of a suitable petroleum crude oil. Reference to PG asphalt binder within this specification includes virgin PG asphalt binder and PG asphalt binder / liquid anti-stripping agent combinations, as the case may be.

.3 Contractor is the Party that enters into an agreement to provide the required materials and to perform the Work on the project at a predetermined price or rate.

.4 Engineer as referred to in this specification, shall be Engineering Manager Municipal Works Department, City of Medicine Hat or designated representative.

.5 Performance Grading (PG) is an asphalt binder specification and grading system that was one of the outcomes of the Strategic Highway Research Program (SHRP) in the late 1980's and early 1990's. The PG asphalt binder specification is part of the Superior Performing Asphalt Pavement (Superpave^{TM}) system for materials selection, testing, and mix design.

.6 Project Engineer shall be City Engineer or designated representative or shall mean the licensed professional Engineer retained by the Developer.

.7 Quality Assurance (QA) is the planned and systematic activities, on the part of a purchaser or owner, implemented in a quality system so that the quality requirements for a material, product or service are verified or confirmed.

.8 Quality Control (QC) is the operational techniques and activities, on the part of a material, product or service provider, used to achieve and maintain the material, product or service to the required quality.

2. PRODUCTS

2.1 PG Asphalt Binder

.1 The Contractor must supply the types and grades of PG asphalt binder as specified in the contract.

.2 The PG asphalt binder must meet the requirements of this specification and the requirements of Alberta Transportation's current Standard Specification for Highway Construction, Section 5.7 Supply of Asphalt including all applicable Special Provisions and Specification Amendments. In the case of a discrepancy between this specification and Section 5.7 Supply of Asphalt this specification will govern.

.3 All PG asphalt binders must be prepared from the refining of petroleum crude oil in a straight run refining process with no air blowing or the addition of chemical agents. PG asphalt binders must be uniform in character, must be free from impurities, and must not foam when heated to 175°C.

.4 Re-refined Engine Oil Bottoms (REOB), also known as Vacuum Tower Asphalt Extenders (VTAE) must not be added, in any proportion, to the PG asphalt binder. The Project Engineer may perform period chemical analysis to determine if REOB / VTAE has been used.

.5 The Contractor may be required to use more than one type or grade of PG asphalt binder for a particular purpose on a project. The Engineer must approve in writing any change in PG asphalt binder type or grade prior to the change being made by the Contractor.

.6 Liquid anti-stripping agents, listed in the most current edition of the Alberta Transportation Products List, may be added to the PG asphalt binder at a rate not to exceed 0.5% by weight of virgin PG asphalt binder. The PG asphalt binder / liquid anti-stripping agent combination must meet the PG asphalt binder requirements of this specification. Liquid anti-stripping addition rates greater than 0.5% by weight of virgin PG asphalt binder will only be allowed if the Contractor completes laboratory testing to confirm that the treated virgin PG asphalt binder meets the requirements of this specification and receives written approval from the Engineer.

.7 The Engineer may consider the use of a liquid anti-stripping agent that is not in the most current Alberta Transportation Products List at the written request of the Contractor. The Contractor must provide sufficient time and all the supporting documentation on the use and long-term performance of the proposed anti-stripping agent required by the Engineer to make a written determination in writing on its use.

.8 The Contractor may use hydrated lime at an additive rate as determined by the HMA mix design but the additive rate must be at least 1.4% by weight of dry aggregate in place of a liquid anti-stripping agent. The hydrated lime must meet the requirements of AASHTO M303 Lime for Asphalt Mixtures. The Contractor must include the details of the proposed procedures for uniformly incorporating the hydrated lime into the asphalt mix as part of the HMA mix design submission.

2.2 Materials Certification

.1 At least 3 weeks prior to commencing Work on the project submit written and signed certification, from the PG asphalt binder manufacturer, that the PG asphalt binder complies with these specifications. This certification must include but is not limited to:

.1 Name of the PG asphalt binder manufacturer.

.2 Source(s) of the base asphalt binder(s).

.3 Type and source(s) of additives.

.4 Current laboratory test results for the PG asphalt binder.

.5 A certification statement that the PG asphalt binder is a straight run, non-air blown/oxidized, non-chemically modified asphalt binder and, if the asphalt binder is modified, it has only been modified with Styrene Butadiene (SB) or Styrene Butadiene Styrene (SBS) type copolymers.

.2 At least 10 working days prior to commencing HMA production submit a current temperature-viscosity chart for each required PG asphalt binder showing the Kinematic Viscosity in mm^2 per second (centistoke) over a temperature range of at least 105°C to 175°C that indicates the recommended mixing and compaction temperatures for the PG asphalt binder. In lieu of the temperature-viscosity chart, the recommended mix and compaction temperature for the PG asphalt binder, as recommended by the PG asphalt binder manufacturer may be provided. This submission is to be included as part of the HMA mix design submission.

2.3 Sampling and Testing

.1 All PG asphalt binder may be subject to inspection, sampling, and testing by the Project Engineer.

.2 Upon written request by the Project Engineer submit manufacturer's most recent test data indicating that the PG asphalt binder meets requirements of this specification and Alberta Transportation's current Standard Specification for Highway Construction, Section 5.7 Supply of Asphalt including all applicable Special Provisions and Specification Amendments.

.3 The Contractor must obtain representative, uncontaminated samples of each type and grade of the PG asphalt binder delivered for use on the project for QA testing. Samples must be obtained once from every 1,500 tonnes of PG asphalt binder delivered to the PG asphalt binder storage facility. At least 1 sample of each type of PG asphalt binder must be obtained for each project, regardless of project size, unless directed otherwise, in writing by the Engineer.

.4 The QA samples must be appropriately labelled in order to identify the Contractor, PG asphalt binder supplier, date and time sampled, type and grade of PG asphalt binder, type and amount of liquid anti-stripping agent, and the weigh bill number of the load.

.5 The Contractor must supply a weight scale that must be inspected and certified by an Authorized Service Provider recognized by Measurement Canada, an agency of Innovation, Science and Economic Development Canada, at the Contractors' expense prior to the start of the supply of PG asphalt binder and as often thereafter, as the Project Engineer may direct in writing.

2.4 Quality Control

.1 The Contractor must have monitoring procedures in-place to provide daily "bulk" measurements of all materials used to produce HMA at the asphalt plant; including anti-stripping agents and any other additives, as applicable, to verify that usage quantities match targeted values. If requested in writing by the Project Engineer, the Contractor must provide the daily bulk quantity checks within 1 working day of the HMA being placed on the project.

2.5 Quality Assurance

.1 The Contractor must deliver QA samples to the Project Engineer 1 working day after they were obtained.

.2 The Project Engineer may test random QA samples. If a tested sample indicates non-compliant PG asphalt binder the QA sample immediately prior and immediately after will also be tested.

.3 Acceptance or rejection of the PG asphalt binder will be based on the test results.

3. EXECUTION

3.1 Delivery and Storage

.1 Provide storage facilities capable of heating the PG asphalt binder under effective and positive control at all times. All PG asphalt binder storage facilities must be equipped with sampling valves maintained in good operating condition which are designed and locate to enable safe, representative sampling into the appropriate 1 or 2 litre containers of the PG asphalt binder. The Contractor must provide safe, convenient access, acceptable to the Project Engineer, for inspection and sampling of the PG asphalt binder, and must cooperate in the inspection and sampling process when requested to do so.

.2 The Contractor must follow the manufacturer's specified handling and storage requirements for each grade of PG asphalt binder.

.3 The Contractor must prevent contamination of the PG asphalt binder, by asphalt binder or PG asphalt binder of another type or grade, by solvent, or by any other material.

.4 No PG asphalt binder type or grade must be diluted or mixed with a different type or grade of asphalt binder, or with any other material, without the specific written approval of the Engineer.

.5 PG asphalt binder storage tanks must be emptied of one type or grade of PG asphalt binder or asphalt binder, and cleaned as necessary to prevent detrimental contamination of the PG asphalt binder, before placing another type or grade of PG asphalt binder therein.

.6 When the liquid anti-stripping agent is added by the PG asphalt binder supplier the type and percentage of liquid anti-stripping agent must be listed on each PG asphalt binder delivery weigh bill.

.7 When the liquid anti-stripping agent is added at the HMA mixing plant the Contractor must provide documentation from the PG asphalt binder manufacturer that the proposed liquid anti-stripping agent is compatible with the asphalt crude source and

PG asphalt binder grade contained in the mix design when added within the dosage range recommended by the additive supplier.

.8 When a liquid anti-stripping agent is added to the PG asphalt binder at the HMA mixing plant, the liquid anti-stripping agent must be introduced through a separate, calibrated pumping and metering system electronically interlocked with the operating controls of the mixing plant. The Contractor must have a procedure in-place enabling the safe sampling of treated PG asphalt binder including an in-line valve and sampling system.

.9 If hydrated lime is used in place of a liquid anti-stripping agent the feed system must be calibrated to provide a consistent and accurate feed of dry hydrated lime into the mixing plant prior to the PG asphalt binder injection point. The hydrated lime feed system shall be synchronized to the rate of aggregate feed and must be electronically interlocked with the operating controls of the mixing plant.

.10 The Contractor must provide, maintain and reclaim PG asphalt binder storage facilities.

.11 Provide to the Project Engineer, upon written request, all freight and weight bills / bill of lading for PG asphalt binder, liquid anti-stripping agent, and hydrated lime shipments received.

3.2 Acceptance

.1 PG asphalt binder supplied and incorporated into the project will be considered for acceptance provided the required QA samples have been provided to the **Project** Engineer within the time frame specified and where the both the PG asphalt binder and the HMA concrete in which the PG asphalt binder was used meet the requirements of the specifications.

.2 If non-compliant PG asphalt binder is identified by the Engineer, the field placement of the HMA concrete containing the non-compliant PG asphalt binder must be suspended until the Contractor, Project Engineer and Engineer can determine the impact of the non-compliance and what the necessary remedial actions to be taken by the Contractor will be. Remedial actions must be either acceptance at full payment, acceptance at a payment adjustment or rejection.

.3 If the Contractor, Project Engineer and Engineer cannot agree on an acceptable payment adjustment for the HMA concrete which contains the non-compliant PG asphalt binder the Contractor, Project Engineer and the Engineer will jointly hire an independent third party to determine the payment adjustment.

.4 If, in the written opinion of the Engineer, any PG asphalt binder that fails to meet the required specifications is significant enough to result in the probable unsatisfactory performance of the HMA concrete in which the PG asphalt binder was used, it will be rejected. The Contractor must remove and replace all the HMA concrete containing the failed PG asphalt binder. Removal and replacement of the rejected PG asphalt binder and HMA concrete must be at the Contractor's cost. If the Contractor disagrees and submits in writing to the Engineer within 3 working days of receipt of notice from the Engineer that the HMA concrete is rejected, the Contractor, Project Engineer and the Engineer will jointly hire an independent third party to determine if the non-compliant PG asphalt binder will result in the probable unsatisfactory performance of the HMA concrete and its subsequent rejection.

.5 If the Contractor, Project Engineer and the Engineer cannot agree on an independent third party, the Contractor, Project Engineer and Engineer will each nominate an independent third party to a Panel and those parties will select an independent third party to act as the chair of the Panel. The Panel will then determine the payment adjustment or if the HMA concrete should be rejected.

.6 All costs for the independent third party or the Panel will be split evenly between the Contractor and the Project Engineer.

.7 If suspended, the paving program must only recommence upon written authorization of the Engineer.

4. MEASUREMENT AND PAYMENT

.1 If the contract indicates a bid item for the supply of PG asphalt binder, measurement will be based on weigh bills provided by the manufacturer to the Contractor.

.2 Delivery quantities may be confirmed by weighing the delivery vehicles before and after unloading.

.3 If there is a discrepancy between the confirmed delivery weight and the manufacturer's weight bill, the confirmed delivery weight will be used.

.4 When the contract contains a bid item for the supply of PG asphalt binder, payment for the accepted PG asphalt binder, utilized as per the project requirements, must be at the applicable unit price per tonne in the contract documents.

.5 Where the contract does not contain a bid item for the supply of PG asphalt binder, accepted PG asphalt binder will not be paid for as a separate item. Payment for the PG asphalt binder is then considered to be included in the unit price bid for the contract item in which the PG asphalt binder was used.

.6 All costs associated with the supply and incorporation of any anti-stripping agent regardless of whether the anti-stripping agent is incorporated by the PG asphalt supplier or the Contractor, must be included in the unit price bid for supply of PG asphalt binder (if there is one) or for the unit price bid for the contract item in which the PG asphalt binder and anti-stripping agent is to be used. No separate or additional payment will be made for the addition of an anti-stripping agent.

.7 Payment will be the full compensation for supplying PG asphalt binder and anti-stripping agent, if required, to the project including ordering, scheduling, delivery, storage facilities, handling, storing, sampling, testing, and other related items.

END OF SECTION

HOT MIX ASPHALT CONCRETE

1. GENERAL

1.1 Description

.1 This section specifies requirements for the Hot Mix Asphalt (HMA) concrete paving under a Quality Assurance Specification framework.

.2 The Work includes the supply of aggregates, asphalt binder, Reclaimed Asphalt Pavement (RAP) and anti-stripping agent (where applicable), asphalt plant mixing, transporting, placement, compaction, and finishing, all to the requirements of this specification.

.3 This section includes the material requirements, material certification, quality control testing, HMA mix design preparation and submission, HMA production tolerances, HMA construction requirements, quality assurance testing, quality assurance appeals, product acceptance and rejection, data analysis, reporting, and measurement and payment as required by the project.

1.2 Related Sections

.1 Prime, Tack, and Fog Coats – Section 05110.

.2 Asphalt Binder – Section 05130.

.3 Performance Graded Asphalt Binder – Section 05135.

.4 Hot Mix Asphalt Concrete Trails – Section 05150.

1.3 Definitions

.1 Acceptance is the process undertaken by the Engineer in which the available Quality Control and Quality Assurance test data is reviewed and the Work is inspected by Project Engineer to ensure that it meets the requirements of the specifications. Recommendation for acceptance may be provided by Project Engineer.

.2 Asphalt Binder Content is the as determined asphalt binder content of the HMA or RAP (if used) regardless of the type and grade of asphalt binder or PG asphalt binder.

.3 Asphalt Concrete is the final HMA that has been placed, compacted, and finished on a prepared surface in conformance with the plans and specifications.

.4 Contractor is the Party that enters into an agreement to provide the required materials and to perform the Work on the project at a predetermined price or rate.

.5 Engineer as referred to in this specification, shall be Engineering Manager Municipal Works Department, City of Medicine Hat or designated representative.

.6 Job Mix Formula (JMF) establishes the proportioning of the aggregates and RAP (if used), combined aggregate gradation, approved asphalt binder type and content, type and amount of anti-stripping agent (where applicable), and the mixing temperature to be used for the production of the HMA.

.7 Hot Mix Asphalt is a high quality, thoroughly controlled mixture of crushed aggregates, or a combination of crushed aggregates, RAP, natural fines, manufactured fines, asphalt binder, anti-stripping agent and other additives (where applicable), which are combined, heated, discharged from a HMA mixing plant,

transported and subsequently placed, compacted, and finished for use in HMA asphalt concrete.

.8 Lot is a portion of the Work being considered for Acceptance and is 1 day of HMA production, per mix type. At the Engineer's written discretion, any portion of the Work may be deemed to be a Lot.

.9 Pre-Production Quality Control is the QC of materials and processes conducted by the Contractor, in accordance with this specification, prior to HMA plant mixing.

.10 Production Quality Control is the QC of materials and construction conducted by the Contractor, in accordance with this specification, during and after HMA plant mixing.

.11 Project Engineer shall be City Engineer or designated representative or shall mean the licensed professional Engineer retained by the Developer.

.12 Quality Assurance (QA) is the planned and systematic activities, on the part of a purchaser or owner or designate, implemented in a quality system so that the quality requirements for a material, product and/or service are verified or confirmed.

.13 Quality Assurance Specification is a specification whereby the methods of construction are not completely defined and require Contractor QC and Project Engineer QA and Acceptance of the Work. The Contractor is responsible for QC and the Project Engineer will monitor the Contractor's control of the process that produces the Work. The Project Engineer will undertake QA and Inspection to accept the Work.

.14 Quality Control (QC) is the operational techniques and activities, on the part of a material, product or service provider, used to achieve and maintain the material, product or service to the required quality.

.15 Slurry Seal is a homogenous mixture of crushed aggregate, mineral filler, additives (as required), emulsified asphalt, and water designed to be a slurry. At the discretion of the Engineer, it may be applied to a pavement as a surface treatment in order to fill minor cracks and moderately segregated areas or to restore HMA to a uniform surface texture.

.16 Theoretical Maximum Specific Gravity as determined by ASTM D2041 and referred to herein as Maximum Theoretical Density (MTD).

2. PRODUCTS

2.1 HMA Mix Types

.1 HMA mix types are selected on a project specific basis, as required by the nature of the project and the required HMA concrete quantities. Mix type designations and typical applications are as follows:

.1 Mix type S1 - Surfacing HMA for high traffic applications, including arterial and industrial classified roadways, using either 120-150(A) premium grade asphalt binder and/or Performance Grade (PG) 64-28 or PG 58-28 asphalt binder, as identified in the contract:

.1 PG 64-28 asphalt binder would be preferred for applications with high truck traffic and/or slower speed roadways with frequent signalized intersections.

.2 120-150 (A) premium grade or PG 58-28 asphalt binder would be utilized for lower truck traffic applications and/or roadway sections with no, or few signalized intersections.

.2 Mix type S2 - Surfacing HMA for low to medium traffic applications, such as local and minor collector roadways, and for Hot Mix Asphalt Concrete Trails using 150-200 (A) premium grade or PG 58-34 asphalt binder, as identified in the contract.

.3 Mix type B1 - Base course HMA for all traffic applications using 150-200 (A) premium grade or PG 58-34 asphalt binder, as identified in the contract.

.4 Mix type M1 - Maintenance HMA for patching, levelling course, and thin overlay of low traffic roadways, using 150-200 (A) premium grade or PG 58-34 asphalt binder, as identified in the contract.

2.2 Materials

.1 Asphalt Binder to the requirements of Section 5130 Asphalt Binder.

.2 PG Asphalt Binder to the requirements of Section 05135 Performance Graded Asphalt Binder.

.3 Aggregates:

.1 Coarse aggregate is material retained on the 5 000 µm sieve; fine aggregate is material passing the 5 000 µm sieve.

.2 Aggregates must be crushed stone or gravel consisting of sound, hard, durable, angular particles, that are free from injurious quantities of flat and elongated particles, soft shale, clay lumps, organic material, frozen material, and all other deleterious materials.

.3 Aggregate gradations are to be within the limits specified and are to be determined by Alberta Transportation (AT) Test method (ATT) ATT-26. The percent passing all sieve sizes is to be reported to the nearest 0.1%.

.4 Aggregate must be processed to meet the following:

.1 Natural fines must be pre-screened from the pit-run and separately stockpiled with 90% passing the 5 000 µm sieve.

.2 Material delivered to the crushing plant must be pre-screened and must contain not more than 5% passing the 5 000 µm sieve.

.3 Material produced by the crushing operation must be separated into coarse aggregate and fine aggregate stockpiles. The coarse aggregate fraction must not have more than 10% of the material passing the 5 000 µm sieve. The fine aggregate fraction or manufactured fines must have 90% of material passing the 5 000 µm sieve.

.4 Blend sand must consist of natural or manufactured sand with 90% of the material passing the 5 000 µm sieve.

.5 Physical properties of aggregates to meet the requirements in Table 2.2.3.5.1:

Table 2.2.3.5.1
Aggregate Physical Property Requirements

REQUIREMENT	TEST STANDARD	ALL MIX TYPES
Los Angeles Abrasion (% Loss)	ASTM C131	30.0 max.
Flat and Elongated Particles 5:1 ratio (% by mass)	ASTM D4791	10.0 max.
Magnesium Sulphate Soundness (% Loss) Coarse Aggregate: Fine Aggregate:	ASTM C88	 12.0 max. 12.0 max.
Sand Equivalent (mechanical method)	ASTM D2419	45 min.
Lightweight Particles (%), see Note 1	ASTM C123	1.5 max.
Detrimental Matter, (%)	AT TLT107	3.0 max.
Plasticity Index (Fine Aggregates)	ASTM D4318	Non-Plastic

Note 1: The heavy liquid must be a solution of zinc bromide in water with a specific gravity of 2.40.

.6 Blended Aggregate Requirements:

.1 The combined aggregate gradation requirements, including RAP (if used) must meet the requirements of Table 2.2.3.6.1.1:

Table 2.2.3.6.1.1
Blended Aggregate Gradation Requirements

SIEVE SIZE (μm)	% PASSING SIEVE SIZE			
	MIX TYPE S1	MIX TYPE S2	MIX TYPE B1	MIX TYPE M1
25 000	-	-	100	-
20 000	100	-	100 - 97	-
16 000	100 - 97	100	100 - 83	-
12 500	100 - 90	100 - 97	92 - 70	100
10 000	90 - 67	95 - 80	84 - 61	100 - 97
5 000	65 - 45	70 - 45	65 - 38	75 - 55
2 500	53 - 31	57 - 31	52 - 26	59 - 35
1 250	42 - 21	45 - 21	41 - 18	45 - 24
630	33 - 15	36 - 15	31 - 13	36 - 16
315	24 - 9	28 - 9	22 - 9	26 - 10
160	15 - 6	18 - 6	14 - 6	18 - 7
80	8 - 4	8 - 4	8 - 4	9 - 4

.2 Coarse Aggregate Fracture of the combined aggregate including RAP (if used) of all material retained on the 5 000 μm sieve by mass must be as indicated in Table 2.2.3.6.2.1:

Table 2.2.3.6.2.1
% Coarse Aggregate Fracture Requirements

	MIX TYPE S1	MIX TYPE S2	MIX TYPE B1	MIX TYPE M1
SIEVE SIZE (μm)	2 FACE min.	2 FACE min.	2 FACE min.	2 FACE min.
-25 000 to +16 000	90	-	70	-
-16 000 to +10 000	90	80	75	-
-10 000 to +5 000	95	85	80	65
Combined +5 000	90	85	75	65

.3 Manufactured fines content of the total combined aggregate including RAP (if use) of all material passing the 5 000 μm sieve (by mass) must be as follows:

.1 Mix type S1 - 75% minimum.

.2 Mix type S2 - 70% minimum.

.3 Mix type M1 - 65% minimum.

.4 Mix type B1 - 65% minimum.

.4 Reclaimed Asphalt Pavement:

.1 RAP must not contain any other additives including, but not limited to, sulphur, crumb rubber, asphalt rubber, asbestos, Recycled Asphalt Shingles (RAS), paving fabrics, reinforcement grids, or other deleterious materials.

.2 Stockpile a minimum of 100% of total amount of RAP required before commencing the HMA mix design.

.3 The maximum RAP portion by mass of total aggregates must be less than 15% for all mix types and the ratio of virgin asphalt binder to total asphalt binder must be greater than 80% for mix type S1, S2, and M1 and greater than 75% for mix type B1.

.4 For mix types incorporating RAP 50% of the RAP material passing the 5 000 μm sieve will be considered to be manufactured fines.

.5 The maximum size of the RAP must be less than 25 000 μm immediately prior to feeding into the HMA mixing plant.

.5 Delivery and Storage:

.1 Stockpile a minimum of at least 50% of total amount of each individual aggregate required before commencing the HMA mix design.

.2 Stockpile a minimum of 100% of total amount of RAP required before commencing HMA production.

.3 Aggregate stockpile volumes must be maintained to ensure a minimum of 5,000 tonne of HMA mixing plant production or the entire remaining project quantity, whichever is less.

2.3 HMA Mix Design

.1 A HMA mix design for each mix type required on the project must be prepared and submitted to the Engineer for review and accepted at least 10 working days prior to the start of HMA production. The Contractor must use a qualified Engineering and materials testing service licensed to practice in the Province of Alberta to prepare the HMA mix design.

.2 The HMA mix design must follow the "Marshall Method of Mix Design" (Chapter 7) for sample preparation and "Volumetric Properties of Compacted Paving Mixtures" (Chapter 5) for HMA void properties as outlined in the latest edition of the Asphalt Institute's Manual Series No. 2 (MS-2) Asphalt Mix Design Methods. The HMA mix design must include 5 separate trial asphalt binder contents for each aggregate combined gradation and the trial asphalt binder contents must be in 0.50% increments reported to the nearest 0.01%. Short-term conditioning of the loose mix must follow "Laboratory Mixture Testing" (Chapter 4) in MS-2 and be for 2 hours +/- 5 minutes at the compaction temperature before the MTD (Gmm) and Bulk Specific Gravity of the compacted mix (Gmb) is determined for each of the 5 separate trial asphalt binder contents. The "best fit" smooth curve required to connect the plotted data points must be graphed as a second order polynomial.

.3 At the recommended design asphalt binder content the HMA must meet the requirements of Table 2.3.3.1:

Table 2.3.3.1
HMA Physical Property Requirements

PROPERTY	REQUIREMENTS			
	MIX TYPE			
	S1	S2	B1	M1
Number of blows/face, see Note 1	75	50	75	50
Marshall Stability (kN)	12.0 min.	8.0 min.	10.0 min.	5.3 min.
Marshall Flow (mm)	2.0 - 3.5	2.0 - 4.0	2.0 - 4.0	2.0 - 4.0
Air Voids (%), see Note 2 and 3	3.8 - 4.2	3.3 - 3.8	4.3 - 4.7	2.8 - 3.2
Voids in Mineral Aggregate (%)	14.0 min.	14.0 min.	12.5 min.	14.0 min.
Voids Filled With Asphalt (%)	65 - 75	70 - 80	60 - 70	70 - 80
Film Thickness (μm)	7.5 min.	7.5 min.	6.5 min.	7.5 min.
Tensile Strength Ratio (%)	75 min.	75 min.	75 min.	75 min.

Note 1: Compaction accomplished with a manually held and operated hammer.

Note 2: The recommended design asphalt binder content must be chosen such that the design Air Voids is the lowest value within the range indicated such that all the other mix design criteria are met.

Note 3: In addition, the Air Voids are to be determined by comparison to the MTD and by calculation utilizing the Specific Gravity of the compacted HMA mix (Gmb), Specific Gravity of the combined aggregates (Gsb), Specific Gravity of the asphalt binder (Gb), asphalt binder absorption of the combined aggregates (Pba), and the total asphalt binder content (Pb).

.4 Include the following data with the HMA mix design submission:

.1 Pit name and legal description of all aggregate sources.

.2 Source of RAP (if used).

.3 Gradations of individual aggregates and RAP (if used).

.4 For each aggregate and RAP (if used) the 2 face fracture counts for the sieve sizes indicated in Table 2.2.3.6.2.1.

.5 Los Angeles Abrasion for each coarse aggregate, Magnesium Sulphate Soundness, Sand Equivalent, Flat and Elongated Particles, Lightweight Particles, Detrimental Matter Content, Plasticity Index, and percent Manufactured Fines values.

.6 Bulk Specific Gravity (Gsb) and water absorption of the individual aggregates.

.7 RAP asphalt binder content (if used), Bulk Specific Gravity of the recovered RAP asphalt binder (GbRAP), MTD of the RAP, and the Bulk Effective Specific (GseRAP) of the RAP aggregate (based on the MTD of the RAP and RAP asphalt binder content).

.8 Asphalt binder manufacturer, Bulk Specific Gravity of the asphalt binder (Gb), and mixing and compaction temperatures based on temperature–viscosity properties of asphalt binder or the supplier's recommended mixing and compaction temperature for PG asphalt binders.

.9 Liquid anti-stripping agent supplier (if used), product identification, product specification sheet, and application rate. If hydrated lime is used as an anti-stripping agent the product identification, product specification sheet, and application rate. The hydrated lime must also be accounted for, as a mineral filler, when determining the blend percentages and combined aggregate gradation. In addition, details of the procedures to be used to uniformly incorporate the hydrated lime into the aggregates at the mixing plant to ensure consistent HMA production.

.10 Based on the individual aggregate results and the blend proportions the combined aggregate Bulk Specific Gravity (Gsb), combined aggregate Effective Specific Gravity (Gse), and Asphalt Absorption (Pba). For HMA containing RAP the GseRAP is to be used in the determination of the combined aggregate Gsb.

.11 Graph of the mix's MTD and all other associated mix properties.

.12 Recommended design asphalt binder content, reported to the nearest 0.01%, associated mix properties including the Tensile Strength Ratio (TSR) at the recommended design asphalt binder content, and virgin asphalt binder to total asphalt binder content ratio for mixes containing RAP.

.13 Ignition oven asphalt binder correction factor.

2.4 Job Mix Formula

.1 Subject to acceptance in writing by the Engineer, the individual aggregate gradations, the aggregate proportioning (including RAP and anti-stripping agent), target combined aggregate gradation, recommended design asphalt binder content, design air void content, and mixing temperature from the mix design will become the JMF for the supply of the mix type for which it applies to.

.2 Production of HMA of any mix type for use on the project must not begin until the Engineer has in writing accepted the mix design and JMF.

.3 Once established, no alterations to the JMF will be permitted unless a new JMF is submitted by the Contractor and is accepted in writing by the Engineer. Any alteration to the JMF must not result in HMA properties that do not meet the requirements of this specification.

.4 If alterations to the JMF are in excess of any one of the following limits, HMA production must stop and a new HMA mix design must be submitted for acceptance in writing by the Engineer:

- +/- 5.0% passing the 5 000 µm sieve.
- +/- 1.5% passing the 80 µm sieve.
- +/- 3.0% in RAP blend (if used).
- +/- 0.30% asphalt binder content.

2.5 Production Tolerances

.1 All HMA must be produced to the JMF within the range of tolerances specified.

.2 Asphalt binder content to +/- 0.30% of the accepted JMF value.

.3 HMA mix temperature at point of mixing plant discharge must not vary from the JMF mixing temperature by +/- 15°C.

.4 Aggregate gradation from the JMF combined gradation must meet the requirements of Table 2.5.4.1 provided the as produced HMA combined gradation remains within the limits indicated in Table 2.2.3.6.1.1:

Table 2.5.4.1
Aggregate Gradation Tolerances

AGGREGATE PASSING SIEVE SIZE (µm)	TOLERANCE (% BY MASS)
Max. Size to 5 000	+/- 5.0
2 500 & 1 250	+/- 3.0
630 & 315	+/- 2.0
160	+/- 1.5
80	+/- 1.5

.5 HMA Air Voids to +/- 0.5% of the JMF value, as calculated utilizing the Bulk Specific Gravity of the compacted mix (Gmb) and the MTD (Gmm) of the loose mix.

.6 HMA mix properties including Marshall Stability, Marshall Flow, Voids in Mineral Aggregate, Voids Filled with Asphalt, Film Thickness, Retained Stability, and Tensile Strength Ratio (TSR) to the limits identified in Table 2.3.3.1.

.7 Coarse aggregate fractured face count to the limits identified in Table 2.2.3.6.2.1.

.8 Maximum moisture in HMA mix, at point of plant discharge must be less than 0.2% by mass of HMA mix.

.9 HMA mix temperature upon arrival on the project must not exceed the mixing temperature indicated in the JMF by 10°C.

2.6 Sampling and Testing

.1 The Project Engineer must have access to all production processes and materials used for the Work to monitor material quality as often as deemed necessary. Such inspection and testing will not in any way relieve the Contractor of the responsibility for meeting the requirements of the specifications.

.2 At least 21 working days prior to commencing Work, inform the Project Engineer of the proposed source of aggregates and provide access for sampling.

.3 Quality Control:

.1 The Contractor will be totally responsible for production of materials and construction that meet all specified requirements.

.2 QC is the responsibility of the Contractor throughout every stage of the Work from aggregate processing to the final accepted product. Tests performed by the Project Engineer will not be considered as QC tests.

.3 All QC materials testing must be conducted by qualified agencies and personnel. The minimum qualification requirements are indicated in the City of Medicine Hat's "Guideline for Material Testing Agencies and Personnel Qualifications". The Contractor will bear the cost of all QC testing and consulting services.

.4 Pre-Production QC testing and sampling and minimum frequencies are described in Table 2.6.3.4.1 Pre-Production Quality Control Requirements:

Table 2.6.3.4.1
Pre-Production Quality Control Requirements

Quality Control Requirement	Minimum Frequency
Asphalt Binder Certification	1 per year per type or for each change in manufacturer
Aggregate Physical Properties, Table 2.2.3.5.1	1 per year or for each change in source
Crushed Coarse Aggregate(s) Gradation Analysis and Fracture Count	1 for every 1,000 tonne of each material type processed into stockpile but no less than 1 analysis for each production day
Manufactured Fines Gradation	
Natural Fines Gradation	
RAP Asphalt Binder Content, Extracted Aggregate Gradation and Fracture Count	1 for each 500 tonne delivered to stockpile or 1 for each location when delivery rate is less than 500 tonne
HMA Mix Design by Marshall Method, Section 2.3	1 per year and as required for a change in asphalt binder supply, aggregate gradation, aggregate source or as per Section 2.4.5, see Note 1
Plant Calibration	As required

Note 1: An accepted HMA mix design, from only the immediately preceding construction season, may be accepted in writing by the Engineer if there are no new production of

aggregates or changes in materials for which the original HMA mix design was accept and provided that there are no changes to the previously approved JMF.

.5 Pre-Production QC test data as specified in Table 2.6.3.4.1 must be reported to the Project Engineer for acceptance 3 weeks prior to commencing Work on the project or as requested.

.6 Production QC testing and sampling and minimum frequencies are described in Table 2.6.3.6.1 Production Quality Control Requirements:

Table 2.6.3.6.1
Production Quality Control Requirements

Quality Control Requirements	Minimum Frequency
HMA Analysis (including Asphalt Binder Content, Aggregate Gradation, Marshall Density, MTD, and Void Properties), see Note 1	1 for every 500 tonne of each mix type supplied under this specification but at least 1 per day for each mix type, see Note 2
TSR	For each mix type, 1 per 5,000 tonne but at least 1 per project only if project uses more than 1000 tonne, see Note 3
HMA Mix Temperature	Minimum frequency not specified
Cold Feed Aggregate Analysis	Minimum frequency not specified
Compaction Monitoring (Core or Nuclear)	Minimum frequency not specified, see Note 4

Note 1: HMA air voids are to be determined by comparison to the MTD and by calculation utilizing the HMA mix design data. If the MTD air voids differ by more than +/- 0.5% of the calculated air voids undertake an analysis to determine the cause of the increased variation and report such to the Project Engineer.

Utilizing the asphalt binder content and the combined aggregate Effective Specific Gravity (Gse) from the mix design calculate the MTD. If the calculated MTD differs from the as tested sample MTD by more than +/- 0.015 undertake an analysis to determine the cause of the increased variation and report such to the Project Engineer.

The asphalt binder content is to be reported to the nearest 0.01%.

Note 2: Where an individual test indicates non-compliance, another test will be initiated immediately.

Note 3: For projects with less than 1000 tonne, TSR QC testing is not required, however, the contractor has to demonstrate additives have been added to the mix to meet the TSR requirement as per approved JMF.

Note 4: Coring is subject to acceptance in writing by the Project Engineer.

.7 Production QC test data as specified in the first row in Table 2.6.3.6.1 must be reported to the Project Engineer within 1 working day of the HMA being placed on the project. The remainder of the production QC test data as specified in Table 2.6.3.6.1 must be reported to the Project Engineer within 7 workings days of the HMA being placed on the project.

.4 Quality Control Compliance with Specified Tolerances:

.1 Asphalt Binder Content, Aggregate Gradation, and HMA Mix Properties:

.1 The test data derived by Production QC testing, described in Section 2.6.3.6, must be compared to the tolerances set forth in Section 2.5. The Contractor must suspend HMA mix production when 3 consecutive results, for any property, are outside of the specified tolerance limits.

.2 Supply of HMA must not commence again until it is demonstrated, to the satisfaction of the Engineer, that corrective action has been taken by means of a trial batch as indicated in Section 2.4.2.

.3 Following initial JMF acceptance, suspension of paving operations under Section 2.6.4.1, or the request for a new JMF under Section 2.4.5, the produced HMA may be subject to rejection, at the written discretion of the Engineer until such time as 3 consecutive Production QC results indicate that all required HMA properties are within the specified tolerance limits.

.2 HMA Temperature

.1 HMA plant mix that does not meet temperature requirements of Section 2.5.3, at the point of plant discharge may be subject to rejection, at the written discretion of the Project Engineer.

.5 Quality Assurance:

.1 Within this specification, certain requirements, limits and tolerances are specified regarding supplied materials and workmanship. Compliance with these requirements will be determined from QA testing as described in this section. All QA materials testing must be conducted by qualified agencies and personnel. The minimum qualification requirements are indicated in the City of Medicine Hat's "Guideline for Material Testing Agencies and Personnel Qualifications".

.2 QA testing is the responsibility of the Project Engineer and the materials testing laboratory undertaking the QA testing must be independent of the materials testing laboratory undertaking QC testing for the Contractor.

.3 Initial QA testing will be undertaken free of cost to the Contractor and QA results indicated in the first row of Table 2.6.5.4.1 will be provided to the Contractor within 1 working day of the Project Engineer receiving the corresponding Production QC results indicated in Table 2.6.3.6.1. The remainder of the QA results indicated in Table 2.6.5.4.1 will be provided to the Contractor within 3 working days.

.4 Sampling and QA testing is described in Table 2.6.5.4.1 Quality Assurance Testing Requirements:

Table 2.6.5.4.1
Quality Assurance Testing Requirements

Acceptance Testing	Minimum Frequency
HMA Analysis (including Binder Content, Aggregate Gradation, Marshall Density, MTD, Void Properties, Marshall Stability and Flow), see Note 1	For each mix type, 1 test for each 3,500 sq. m. of placement, or 3 tests per Lot, which ever is greater
HMA Gradation Fracture Face Count	For each mix type, 1 test per Lot
TSR	For each mix type, 1 test per Lot, see Note 2
Compaction Testing (Cores) and Thickness Determination	For each mix type, 1 test for each 2,000 sq. m. of placement, or 3 tests per Lot, whichever is greater
HMA Mix Temperature	No minimum frequency

Note 1: HMA air voids are to be determined by comparison to the MTD and by calculation utilizing the HMA mix design data. If the MTD air voids differ by more than +/- 0.5% of the calculated air voids undertake an analysis to determine the cause of the increased variation and report such to the Project Engineer.

Utilizing the asphalt binder content and the combined aggregate Effective Specific Gravity (Gse) from the mix design calculate the MTD. If the calculated MTD differs from the as tested sample MTD by more than +/- 0.015 undertake an analysis to determine the cause of the increased variation and report such to the Project Engineer.

The asphalt binder content is to be reported to the nearest 0.01%.

Note 2: TSR samples are to be collected for each Lot but testing for the TSR value is to be done on the even numbered Lots (2, 4, 6, etc.) initially. If an initial result indicates a non-compliant TSR then the odd numbered Lot samples on either side of it will be tested.

.5 Quality Assurance Sampling Procedures:

.1 Loose HMA samples will be acquired from the Work site in accordance with Table 2.6.7.1.1. Auger samples may be used if agreed to in writing by both the Project Engineer and the Contractor.

.2 Loose HMA mix sample timing will be by stratified random sampling, with each sample representing a similar placement or production quantity as indicated in Table 2.6.5.4.1.

.3 Locations for HMA compaction and thickness will be selected using stratified random sampling procedures, as indicated in Table 2.6.7.1.1. The Lot will be divided into segments meeting or exceeding the frequency in Table 2.6.5.4.1 and of approximately equal area.

.4 Areas within 3.0 m of transverse joints or 300 mm of a HMA mat edge or longitudinal joint are excluded from QA sampling and testing for HMA compaction and thickness.

.6 Appeal of Quality Assurance Testing Results

.1 General:

.1 The Contractor may appeal Asphalt Binder Content, Compaction Standard, Gradation, TSR, and HMA Compaction and Thickness for any Lot subject to a payment adjustment or rejection only once. A notice of appeal must be in writing and submitted to the Project Engineer within 3 working days of receipt of notice from the Project Engineer that the Lot is subject to a payment adjustment or rejection.

.2 No appeal of individual QA test results within a Lot will be permitted.

.3 Appeals will only be considered if cause can be shown, to the satisfaction of the Project Engineer, and the requirements of Tables 2.6.3.4.1 and 2.6.3.6.1 have been satisfied.

.4 QC tests initiated after the Contractor's receipt of the QA test results from the Lot being appealed will not be considered when evaluating cause for appeal.

.5 At the Project Engineer’s written discretion, QC testing during production for the subject project will only be considered when evaluating cause for appeal.

.6 The Contractor will have the option for the appeal testing to be performed by the materials testing laboratory undertaking the project QA testing or by an independent materials testing laboratory jointly selected by the Contractor, Project Engineer and Engineer.

.7 For all appeals, all QA test results from the appealed Lot will be discarded. A new Lot mean will be determined using the same number of tests as was used to determine the original appealed Lot mean.

.8 The new Lot mean will be used for acceptance, payment adjustments, and will be binding on Project Engineer, Engineer and the Contractor.

.9 If the new Lot mean shows that any payment adjustment or rejection still applies to the appealed Lot, the costs of the appeal sampling and testing, as well as other ancillary costs such as traffic accommodation for field coring and Engineering reporting costs, will be borne by the Contractor. If the new Lot mean shows that a payment adjustment or rejection no longer applies, the sampling and appeal testing costs will be the responsibility of the Project Engineer.

.2 Asphalt Binder Content Appeal:

.1 The Project Engineer will develop a stratified random sampling plan with the same number of segments as the original number of samples for the appealed Lot. Sufficient core samples (150 mm diameter) will be acquired from each segment to enable asphalt binder content determinations.

.2 For all cored specimens, a diamond saw is to be used to separate the layer to be tested from other pavement layers and to remove all tack or fog coat. The core specimens will also be trimmed to remove cut coarse aggregate as indicated in ATT-12, Part II. Cored specimens taken over crack filler will be discarded and the immediate area re-sampled.

.3 The same test method must be used for the asphalt binder content appeal testing as was used in the original QA testing. If the Contractor chooses the option of selecting an independent laboratory and if the original asphalt binder contents were determined with an ignition oven, then the Contractor must provide sufficient virgin aggregates, RAP (if used), asphalt binder, and anti-stripping agent (where applicable) so that the independent laboratory will be able to determine the ignition oven correction factor.

.3 Compaction Standard Appeals:

.1 The materials testing laboratory conducting the project QA sampling and testing will retain companion samples of sufficient size for the determination of the HMA mix MTD compaction standard.

.2 The same number of compaction standard samples will be tested as the original number of compaction standard samples for the appealed Lot.

.4 Gradation Appeals:

.1 The Project Engineer will develop a stratified random sampling plan with the same number of segments as the original number of samples for the appealed Lot. Sufficient core samples (150 mm diameter) will be acquired from each segment to enable gradation determinations.

.2 The core specimens will also be trimmed to remove cut coarse aggregate as indicated in ATT-12, Part II.

.5 Tensile Strength Ratio Appeals:

.1 The materials testing laboratory conducting the project QA sampling and testing will retain companion samples of sufficient size for the determination of the HMA mix TSR.

.2 The same number of TSR samples will be tested as the original number of TSR for the appealed Lot.

.6 HMA Compaction and Thickness Appeals:

.1 Any attempt to improve HMA compaction on the appealed Lot after the Project Engineer has obtained QA samples will void the appeal and the original QA results will apply.

.2 The Project Engineer will develop a stratified random sampling plan with the same number of segments as the original number of samples for the appealed Lot. Sufficient core samples will be acquired from each segment to enable compaction and thickness determinations.

.7 Methods for Quality Control, Quality Assurance, and Appeal Testing:

.1 Unless otherwise specified, material characteristics will be determined utilizing the current edition of the test method specified in Table 2.6.7.1.1 Quality Control, Quality Assurance, and Appeal Test Methods:

Table 2.6.7.1.1
Quality Control, Quality Assurance, and Appeal Test Methods

Test Description	Test Method
Stratified Random Test Locations	ASTM D3665
Sampling HMA mixes	ASTM D979
HMA Moisture Content	ATT-15
Asphalt Binder Content, see Note 1	ATT-12, Part I or II or 74, Part I
Fractured Face Count	ASTM D5821
Gradation Analysis Aggregates, see Note 2	ATT-26
MTD	ASTM D2041
TSR	AASHTO T283
Marshall Specimens	ASTM D6926
HMA Bulk Specific Gravity	ASTM D2726
Marshall Stability and Flow	ASTM D6927
Retained Stability	TLT 306
Film Thickness	TLT 311
Field Coring	ASTM D5361
Lift Thickness	ASTM D3954
Ignition Oven Correction Factor	ATT-74, Part II
Gradation Analysis RAP	ATT-53

Note 1: Minimum sample size, regardless of mix type, must be at least 2,000 g.

Note 2: In all test methods, metric sieves in accordance with sieve sizes to CAN/CGSB 8-GP-2M rather than ASTM E11.

.2 In the case of a discrepancy between this specification and the test method indicated in Table 2.6.7.1.1, this specification will govern.

2.7 Acceptance

.1 General:

.1 The Contractor must provide Work conforming to the quality and tolerance requirements of this specification. Where no tolerances are specified, the standard of workmanship must be in accordance with accepted industry standards, as indicated in the current edition of “Construction of Hot Mix Asphalt Pavement” Asphalt Institute Manual Series No. 22 and “Hot Mix Asphalt Materials, Mixture Design and Construction” TB-1 as published by the National Asphalt Pavement Association (NAPA).

.2 Acceptance of any Lot at full payment will occur if there are no obvious defects, as indicated in Section 3.13.1 as determined in writing by the Engineer, and the Lot mean results for asphalt binder content, gradation, TSR, HMA compaction, and HMA thickness meet or exceed the specified requirements.

.3 Payment adjustments will only be applied on the basis of QA testing in accordance with Table 2.6.5.4.1.

.4 Failure to satisfy the Production QC requirements indicated in Section 2.6.3 will result in the HMA supplied during such period to be subject to rejection, at the Project Engineer's written discretion.

.5 HMA mix supplied during periods in which 3 consecutive Production QC results indicate that not all required HMA properties are within the specified tolerance limits may be subject to rejection, at the written discretion of the Project Engineer.

.6 HMA not meeting the plant discharge or on-site temperature requirements specified herein will be subject to rejection, at the Project Engineer's written discretion.

.2 Asphalt Binder Content:

.1 For full payment, the Lot Mean Asphalt Binder Content must be within +/- 0.30% of the approved JMF value, as specified in Section 2.4.

.2 Payment adjustment for asphalt binder content is as indicated in Table 2.7.2.2.1 Asphalt Binder Content Payment Adjustment:

Table 2.7.2.2.1
Asphalt Binder Content Payment Adjustment

Lot Asphalt Binder Content Deviation from JMF Value	Payment Adjustment Factor
+/- 0.30 or less	1.00
+/- 0.31 to +/- 0.50	As per Chart A
Greater than +/- 0.50	Reject, see Note 1

Note 1: Subject to removal and replacement, at the written discretion of the Engineer.

.3 HMA Compaction:

.1 HMA compaction will be determined as the ratio (in percent) of the Lot mean field core density divided by the Lot mean MTD. For full payment, the Lot Mean HMA compaction must be equal to or greater than:

.1 94% of the Lot mean MTD for all asphalt layer on arterials, collector and residential local roadways including FAC top lift paving.

.2 93% for Rehabilitation overlay, trails and lane paving

.2 Payment adjustment for HMA compaction is as indicated in Table 2.7.3.2.1 HMA Compaction Payment Adjustment:

Table 2.7.3.2.1
HMA Compaction Payment Adjustment

Arterials, Collector and Local road including FAC top lift paving		Rehabilitation overlay, trails and lane paving	
Lot mean HMA Compaction	**Payment Adjustment Factor**	**Lot mean HMA Compaction**	**Payment Adjustment Factor**
Greater than 94.0	1.00	Greater than 93.0	1.00
91.0 to 94.0	As per Chart B	90.0 to 93.0	As per Chart B
Less than 91.0	Reject, see Note 1	Less than 90.0	Reject, see Note 1

Note 1: Subject to removal and replacement, at the written discretion of the Engineer.

.4 Thickness (New Construction and Top Lift Only):

.1 For full payment, the Lot mean HMA thickness must be equal to, or greater than, the specified HMA thickness.

.2 The Lot Mean Thickness for any Lot will be determined on the basis of the QA cores described in Table 2.6.5.4.1.

.3 Payment adjustment for HMA thickness is as indicated in Table 2.7.4.3.1 HMA Thickness Payment Adjustment:

Table 2.7.4.3.1
HMA Thickness Payment Adjustment

Lot Thickness Deficiency (x% of Specified Thickness)	**Payment Adjustment Factor**, see Note 1	
	Total Thickness (Single or Multiple Lifts), see Note 2	**Top Lift Thickness (Multiple Lifts)**
Compliant or Greater	1.00	1.00
5.0 or less	0.90	0.95
5.1 to 18.9	1.04 - 0.0286x	1.11 - 0.0321x
19.0 or more Deficient	Reject, see Note 3	Reject, see Note 3

Note 1: If both the total thickness and top lift thickness are deficient only a single Thickness Payment Adjustment Factor will be applied, whichever Payment Adjustment Factor is the lower value.

Note 2: Total thickness can be bottom lift for new construction until the final lift of HMA is placed prior to the Final Acceptance Certificate (FAC) inspection.

Note 3: Subject to removal and replacement at the expense of the Contractor, at the written discretion of the Engineer.

.4 If any individual QA core result indicates that the HMA thickness deficiency is 19.0% or greater, additional cores will be obtained to identify the extent of the deficient pavement thickness area. The Contractor will pay for all additional coring costs. Additional cores will be taken 5.0 m from the individual QA core,

longitudinally in the same HMA mat, until the deficient HMA thickness is less than 19.0%. The so determined deficient HMA thickness area will be subject to removal and replacement, at the written discretion of the Engineer. Notwithstanding the Engineer's requirement for removal and replacement the originally determined Lot HMA thickness payment adjustment will be applied.

.5 Smoothness:

.1 The completed HMA surface must be true to the dimensional and tolerance requirements of the specifications and drawings. Unless detailed otherwise in the contract documents the finished HMA surface must be within 5 mm of the design elevation but not uniformly high or low. When checked with a 3.0 m straight edge placed in any direction for both profile and cross-slope irregularities in the finished HMA surface most not exceed the following:

.1 HMA base lifts - 10 mm.

.2 HMA surface lifts - 5 mm.

.2 When irregularities, in excess of the above tolerances are found, the HMA surface must be corrected by methods satisfactory to the Engineer. Correction of defects must be carried out until there are no deviations anywhere greater than the allowable tolerances.

.6 Segregation:

.1 The finished HMA surface must have a uniform texture and be free of segregated areas. Segregation is defined as an area of the HMA surface where the texture differs visually from the texture of the surrounding area. Segregation severity is subjective and the Engineer will have the final determination of the segregation severity.

.2 The Contractor must perform daily inspections of the paving operations to identify any instances of segregation. If segregation is identified on a project, the Contractor must take immediate corrective action to prevent any further occurrences of segregation.

.3 Each Lot will be inspected by the Project Engineer after the Lot is placed. During the inspection the Project Engineer will identify and record any areas of slight, moderate, and severe segregation, as well as, any areas of centre-of-spreader streaks. The Project Engineer will evaluate all segregation to determine the repair requirements.

.4 The severity of segregation will be rated as follows and as indicated in the latest edition of AT's Segregation Rating Manual:

.1 Slight – The matrix of asphalt binder and fine aggregate is in place between the coarse aggregate particles, however there is more coarse aggregate in comparison to the surrounding acceptable HMA that results in small to medium sized surface voids.

.2 Moderate – Compared to the surrounding acceptable HMA, has significantly more coarse aggregate and exhibits a lack of asphalt binder and fine aggregate matrix that results in medium to large sized surface voids.

.3 Severe – Is an area of very stony or very high coarse aggregate mix with stone against stone contact, and very little or no surrounding asphalt binder and fine aggregate matrix that results in large to very large surface voids.

.4 Centre-of-Spreader Streak – Appears as a continuous or semi-continuous longitudinal “streak” consisting of a segregated area of severity varying from slight to severe and typically located in the middle of the spreader mat.

.5 In the case of a discrepancy between this specification and AT’s Segregation Rating Manual this specification will govern.

.6 The Contractor, as directed by the Project Engineer, must repair all segregated areas and centre-of-spreader streaks. The following segregation repair methods are pre-approved:

.1 Slight – squeegee emulsified asphalt, to the requirements of Section 05110.2.3.1, such that the surface voids are completely filled. Premixed commercial emulsion products may be used at the written discretion of the Engineer.

.2 Moderate – remove and replace or HMA overlay, for the full mat width. At the written discretion of the Engineer pre-mixed commercial slurry seal products that contain both mineral aggregates and mineral filler may be used provided the moderate segregation is an isolated occurrence in the Lot. If, for any Lot, more than 3 moderate segregation areas or more than 0.05% of the area contains moderate segregation then, at the written discretion of the Engineer, use of a pre-mixed commercial slurry seal product will not be permitted.

.3 Severe – removal and replacement or HMA overlay for the full mat width.

.7 All repairs must be regular in shape and finished using good workmanship practices to provide an appearance suitable to the Project Engineer

.8 Any other methods of repair proposed by the Contractor will be subject to the written acceptance of the Project Engineer.

.9 Repairs will be carried out by the Contractor at the Contractor’s expense.

.7 Gradation:

.1 The following requirements apply to HMA pavement material in all lifts except preliminary levelling.

.2 Price Adjustments for aggregate gradation variation will be based on the variation of the Lot Mean Gradation from the JMF tolerance, for each sieve size, as shown in Tables 2.7.7.2.1 and 2.7.7.2.2 and the corresponding adjustment points as shown in Table 2.7.7.2.3

Table 2.7.7.2.1

GRADATION TOLERANCES FOR THE LOT MEAN FROM THE JMF AND MAXIMUM RANGE BETWEEN INDIVIDUAL TEST RESULTS IN A LOT

CHARACTERISTICS	SIEVE SIZE (μm)					
	25 000, 20 000, 16 000,12 500,10 0 00, 5 000	2 500, 1 250	630	315	160	80
Tolerances for the Lot Mean from the JMF	+/- 5.0	+/- 3.0	+/- 2.0	+/- 2.0	+/- 1.5	+/- 1.5
Maximum Range between Individual Test Results in a Lot	10.0	6.0	5.0	4.0	3.0	3.0

Table 2.7.7.2.2

MAXIMUM DEVIATION FOR THE LOT MEAN FROM THE GRADATION LIMITS SPECIFIED IN TABLE 2.2.3.6.1.1

CHARACTERISTIC	SIEVE SIZE (μm)		
	20 000, 16 000, 12 500, 10 000	5 000, 2 500, 1 250, 630, 315	160, 80
Maximum Deviation for the Lot Mean from Table 2.2.3.6.1.1 Gradation Limits	+/- 2.0	+/- 1.0	+/- 0.5

Table 2.7.7.2.3

"A" AND "B" ADJUSTMENT POINTS FOR DEVIATION IN GRADATION

SIEVE SIZE μm	LOT MEAN
25 000, 20 000, 16 000, 12 500, 10 000	5 for each 1% Deviation
5 000, 2 500, 1 250	1 for each 1% Deviation
630, 315	2 for each 1% Deviation
160	0.2 for each 0.1% Deviation
80 Deviation < 1.0% 80 Deviation > 1.0%	1.0 for each 0.1% Deviation 0.2 for each additional 0.1% Deviation

.3 When the lot Mean Gradation is outside the JMF tolerance, the penalty assessment will be $0.04 per tonne for each Mean Adjustment Point, up to the limits shown in Table 2.2.3.6.1.1. When the Lot Mean Gradation is outside the limits of Table 2.2.3.6.1.1, the penalty assessment will be $0.40 per tonne for each Mean Adjustment Point outside those limits, regardless of the JMF tolerance. If the maximum deviation shown in Table 2.7.7.2.2 is exceeded the Lot is rejected.

.4 Lot mean Adjustment points will be calculated for each Lot. If the Lot Mean does not exceed the requirements in Table 2.7.7.2.2 a Lot Gradation Price Adjustment per tonne will be applied base on the following formula:

$$PAg = (A \times -0.04) + (B \times -0.40)$$

Where:

PAg = Unit Price Adjustment for Gradation.

A = Mean Adjustment Points assessed within the gradation limits specified in Table 2.2.3.6.1.1 but beyond the JMF tolerance requirements in Table 2.7.7.2.1.

B = Mean adjustment Points assessed outside the gradation limits specified in Table 2.2.3.6.1.1 regardless of the JMF tolerance.

.5 When the Lot Unit Price for HMA in the contract is in square metres a value of 2,320 kilograms per cubic metre will be used for the in-place density of the HMA, regardless of HMA mix type, in the conversion of tonnes of HMA to square metres of HMA.

.8 Payment adjustment for TSR is as indicated in Table 2.7.8.1 TSR Payment Adjustment:

Table 2.7.8.1
TSR Payment Adjustment

Lot TSR Value	Payment Adjustment Factor
75.0 or Greater	1.00
73.5 to 74.9	0.99
72.0 to 73.4	0.97
70.5 to 71.9	0.95
69.0 to 70.4	0.92
67.5 to 68.9	0.89
66.0 to 67.4	0.85
64.5 to 65.9	0.81
63.0 to 64.4	0.76
61.5 to 62.9	0.71
60.0 to 61.4	0.65
Less than 59.9	Reject, see Note 1

Note 1: Subject to removal and replacement at the expense of the Contractor, at the written discretion of the Engineer.

3. EXECUTION

.1 Continuity of Production:

.1 During the time period that Work is in progress on any project for which this specification is in effect, and at the Project Engineer's written discretion, the HMA mixing plant may be limited to producing only the HMA mix type required for that project.

.2 HMA Production:

.1 Preparation of Aggregates:

.1 Aggregates and RAP (if used) must be loaded into separate cold feed bins and be loaded in such a manner that prevents the mixing of the separate aggregate or RAP materials.

.2 To ensure uniformity, aggregates may have to be pre-dried, before they are feed into the HMA mixing plant.

.3 Heating of the aggregates in the HMA mixing plant must be at as low a temperature as is consistent with proper drying, mixing, and lay down and in no case to exceed 25°C over the recommended mixing temperature for the asphalt binder being used.

.2 HMA Plant and Mixing:

.1 HMA mixing plants must be operated in accordance with the manufacturer's recommendations, the specifications and must be calibrated prior to the commencement of HMA production. The Contractor must provide the Project Engineer with a certificate of calibration that indicates that the HMA mixing plant has been calibrated to produce a uniform mixture in accordance with the JMF for each mix type.

.2 When the HMA contains RAP the HMA mixing plant must be capable of thoroughly separating and heating the RAP particles and blend the RAP with the virgin aggregates and asphalt binder. The mixing plant must contain specialized mixing equipment that will prevent the RAP from coming into direct contact with the burner flame to minimize emissions and oxidation of the asphalt binder in the RAP.

.3 The aggregates, RAP (if used), and anti-stripping agent (where applicable) and asphalt binder must be mixed in a manner to produce a consistent, homogeneous mixture in which all particles are uniformly coated with asphalt binder at the point of HMA mixing plant discharge.

.4 HMA mixing plants must be operated in accordance with the "Code of Practice for Asphalt Paving Plants" made under the *Environmental Protection and Enhancement Act*.

.3 Preparation for Paving:

.1 The Contractor must provide the Project Engineer a minimum of 12 hours notice of the intention to commence HMA paving over any previously approved prime coated or tack coated surface.

.2 The HMA must be laid upon a dry, firm surface, true to grade and cross-section, and mechanically swept to be free from all loose or deleterious material. No HMA will be placed when the surface, as determined by the Project Engineer, is wet or when other conditions prevent proper spreading, finishing, or compaction.

.3 If undercutting, and subsequent backfill with HMA is done, the backfill operation must be performed sufficiently far ahead of the paving operation to allow the HMA to be compacted and then sufficient time to cool down in order to support equipment.

.4 HMA Placing - Ambient Air Temperature:

.1 No HMA will be dispatched to the field unless the ambient air temperature, as issued by Environment and Climate Change Canada for the City of Medicine Hat, is rising and meets the following minimum requirements:

.1 HMA thickness equal or less than 50 mm, 7°C.

.2 HMA thickness greater than 50 mm, 2°C.

.2 No surface lift HMA will be placed regardless of ambient air temperature until the road surface, as determined by the Project Engineer, is 5°C or higher.

.5 HMA Placing – Lift Thickness:

.1 Spread the HMA mix uniformly in 1 or more lifts, or as directed by the Project Engineer, to depths sufficient to obtain the design lift thickness. The minimum and maximum thickness of the HMA mix prior to compaction, unless specifically waived by the Engineer in writing, must not exceed the following:

.1 Mix type B1 – 80 mm minimum, 120 mm maximum.

.2 Mix type S1 – 45 mm minimum, 80 mm maximum.

.3 Mix type S2 – 40 mm minimum, 80 mm maximum.

.4 Mix type M1 – 30 mm minimum, 60 mm maximum.

.6 Hours of Operation:

.1 No loads of HMA will be dispatched from the HMA mixing plant after sunset or during hours of darkness unless loads can be placed and compacted in accordance with these specifications, and suitable artificial illumination is provided, all subject to the written acceptance of the Project Engineer.

.7 Transportation of HMA:

.1 HMA haul trucks must be equipped with tarpaulins of sufficient weights and size to cover the entire open area of the truck box. Regardless of weather conditions, tarpaulins must be used.

.2 Vehicles used for the transportation of HMA from the plant to the site of the Work must have tight metal boxes previously cleaned of all foreign matter. Just before loading the inside surface of the truck box may be lightly lubricated with a release agent consisting of a non-petroleum based solution that has been approved in writing by the Project Engineer. Drain all excess release agent from the truck box prior to HMA loading.

.3 The speed and weight of hauling trucks must be regulated so that, in the opinion of the Project Engineer, no damage will occur to any portion of the Work underway. Any damage to the tack coat, prime coat, or the existing surface caused by the Contractor's equipment must be repaired at the Contractor’s expense.

.4 Any load of HMA with a temperature less than 25°C below the recommended mixing temperature indicated in the JMF, will be considered reject, at the written discretion of the Project Engineer.

.5 Deliver HMA mix to the spreader at a uniform rate and in an amount within the capacity of the spreader and compaction equipment.

.8 HMA Spreaders and Rollers:

.1 The HMA spreading machine must be self-propelled and capable of placing a uniform layer of HMA to the depth and grades as shown on the plans or as indicated by the Project Engineer. The spreader must be operated in accordance with the manufacturer's recommended procedures and the specifications.

.2 The screed must include a tamping bar or vibratory strike-off device for use when required. The screed must strike-off the mix to the depth and cross-section specified and produce a finished surface of uniform texture with no open or segregated areas.

.3 Control of the screed must be by automatic sensing devices. Longitudinal control must be accomplished by a sensor, which follows a string-line, ski, or other reference. The grade sensor must be moveable and mounts provided so that grade control can be established on either side of the spreader. A slope control sensor must also be provided to maintain the proper transverse slope of the screed. Use of manual screed controls is subject to the written acceptance by the Project Engineer.

.4 Self-propelled rollers of sufficient number, type, and weight in order to obtain the required degree of compaction and smoothness of the HMA. The rollers must be operated in accordance with the manufacturer's recommended procedures and the specifications.

.5 Keep the tires and steel drums of the rollers slightly moistened with wetting and scraping devices to prevent pick up or adhesion of HMA mix to the tires or drums. Moisten with water or a non-petroleum based release agent, approved in writing by the Project Engineer, but do not over-moisten. Petroleum derivatives are not permitted for use as a cleaning or wetting agent. Pneumatic-tired rollers must be equipped with full coverage wind skirts.

.9 Hand Tools:

.1 Only lutes or rakes must be used during the spreading and finishing operation and when the HMA is worked by hand.

.2 Tamping irons may be used to consolidate the HMA along structures inaccessible to the rollers. Mechanical compaction equipment, satisfactory to the Project Engineer, may be used instead of tamping irons.

.3 For purposes of checking the finished surface, Contractors must provide and carry on each spreading machine a 3.0 m straight edge and slope measuring level.

.4 Use a non-petroleum based release agent, approved in writing by the Project Engineer, to clean the hand tools. Petroleum derivatives are not permitted for hand tool cleaning.

.10 Pre-levelling for HMA:

.1 The Project Engineer will designate, in writing, uneven surface areas or areas having 20 mm or greater depressions that require pre-levelling with HMA mix.

.2 Pre-levelling HMA mix is to be placed must be accomplished by the use of a grader, spreader, hand, or by a combination of these methods, as directed in writing by the Project Engineer.

.3 After placement, the HMA used for pre-levelling must be compacted with a combination of rollers that provide uniform and consistent compaction.

.11 Paving Operations:

.1 The HMA must be placed to the design thickness as shown on the contract drawings. On new construction where an established reference is lacking, a string-line, ski, or other reference will be required. Adjacent mats on the same lift are to be controlled by use of the grade sensor. No relaxation of the above procedure will be permitted without written acceptance of the Project Engineer.

.2 When using spreaders in echelon the second spreader must follow the uncompacted edge of the HMA mix placed by the first spreader. The spreaders must be operated, as close together as is practical but in no case are they to be more than 30 m apart.

.3 The spreader must be operated in such a manner as to distribute the HMA to proper cross-section, width and thickness without causing segregation of the HMA. The forward motion of the spreader must be controlled so that no irregularities in the pavement surface are caused by excessive speed. The rate of placement of the HMA must be uniform and must be co-ordinated with the production rate of the HMA plant without intermittent operation of the spreader.

.4 Any failure of the spreader or operation to produce a smooth, uniformly mat, free from irregularities, segregation or poor workmanship, must be corrected immediately to the satisfaction of the Project Engineer.

.5 Excess HMA mix is to be wasted. Unless approved by the Project Engineer in writing do not pick up any HMA mix that has been placed through the spreader and put it back into the spreader hopper or in front of the augers.

.12 Areas Inaccessible to the Spreading Machine:

.1 Areas that are inaccessible to the spreading machine may be paved by other methods, as approved by the Engineer in writing.

.2 In small areas or where the use of mechanical equipment is not practical, the HMA may be spread and finished by hand. The HMA must be dumped on the area and immediately thereafter distributed into place by shovels and spread with lutes or rakes in a loose uniform layer of uniform density and correct depth. Material must be handled so as to avoid segregation.

.13 Surface Irregularities and Obvious Defects:

.1 The finished surface must be free of visible signs of poor workmanship such as, but not limited to:

- segregation and non-uniform surface texture.
- areas of excess or insufficient asphalt binder.
- improper matching of longitudinal or transverse joints.
- dimpling, cracking, checking, shoving, tearing, ripples.
- screed marks, roller marks, roller pick-outs, tire marks.
- sampling locations not properly reinstated.
- localized low spots or bird baths.

.2 The Contractor must correct irregularities and defects that develop before completion of compaction by loosening the surface of the HMA and removing or adding material, as required.

.3 Areas showing checking or hairline cracking must be repaired by methods approved in writing by the Engineer.

.14 Compaction:

.1 The Contractor must supply sufficient compaction equipment to:

.1 Provide a compaction rate that will equal or exceed the placing rate of the spreader.

.2 Ensure the specified compaction is attained before the temperature of the HMA mat surface falls below 50°C, as determined by an infrared thermometer.

.15 Longitudinal and Transverse Joints:

.1 Longitudinal and transverse joints must be made in a manner consistent with industry standards, as indicated in the current edition of “Construction of Hot Mix Asphalt Pavement” Asphalt Institute Manual Series No. 22 and “Hot Mix Asphalt Materials, Mixture Design and Construction” TB-1 as published by the National Asphalt Pavement Association (NAPA). Coarse aggregate removed from the HMA mix during joint preparation must be wasted and not be broadcast back on to the mat.

.2 Paving joints must not be placed in the same vertical plane. Longitudinal joints must be offset at least 150 mm and transverse joints must be offset at least 2.0 m.

.3 Longitudinal joints must be uniformly aligned to the travel lanes and must not be located within the wheel paths of the travel lane. If permitted in writing by the Engineer the longitudinal joint may be located between the wheel paths at the centre of the travel lane.

.4 Edges where additional HMA mix is to be placed must be vertically formed to true line. A lute or rake must be used immediately behind the spreader when required to obtain a true line and vertical edge.

.5 The exposed edges of all cold HMA joints must be cleaned and painted with a layer of emulsified asphalt tack coat.

.6 At the end of each day’s paving of the surface course and upper lift of the base course mix, the uncompleted paving mats must be provided with vertical transverse joints.

.7 All joints between old and new pavements or between successive days production must be of a vertical butt type, well bonded, sealed and finished to provide a continuous, smooth profile across the joint.

.16 Utility Appurtenances:

.1 Pavement incorporating utility appurtenances, including water valves, gas valves, manholes and other surface utility fixtures must be constructed in a manner satisfactory to the Project Engineer.

.2 A tack coat must be provided to the vertical surface of utility appurtenances prior to paving.

.3 The paved surface adjacent to utility appurtenances must have a tight uniform surface and must be free of segregation.

.4 All catch basins, manholes, water valves, and other roadway fixtures must be brought to the proper elevation before final lift paving. Provide temporary protection where necessary until completion of paving. If catch basins, manholes, water valves, and other roadway fixtures are not raised to their proper elevation and are required to be raised subsequent to final lift paving a $500.00 penalty per occurrence, as documented in writing by the Engineer, will be assessed to the Contractor.

.17 Opening to Traffic:

.1 Prior to any application of traffic, HMA paving mats must be sufficiently cool to resist any deformation or surface scuffing by turning vehicle tires.

.2 Means of cooling (e.g. application of water) the completed HMA pavements prior to opening to traffic may be required, at the Project Engineer's written discretion.

.3 Traffic may be prohibited from travelling on newly paved surfaces, for any length of time deemed necessary by the Project Engineer.

4. MEASUREMENT AND PAYMENT

.1 HMA supplied will be measured in square metres or tonnes of material placed, as detailed in the contract.

.2 The Unit Price for HMA will be full compensation for all materials, labour, tools, equipment and incidentals necessary to complete the Work in accordance with these specifications.

.3 Material must be scaled and recorded by the Contractor on duplicate weight slips. Weight slips must be supplied at the time of delivery and a copy supplied to the Project Engineer.

.4 The weight scale must be inspected and certified by an Authorized Service Provider recognized by Measurement Canada, an agency of Innovation, Science and Economic Development Canada, at the Contractors' expense prior to the start of the supply of HMA and as often thereafter, as the Project Engineer may direct in writing.

.5 The Unit Price applicable to each Lot quantity of HMA will be calculated as follows:

$$\textbf{LOT UNIT PRICE} = (\textbf{CONTRACT UNIT PRICE} + PAg) \times PA_{AC} \times PA_{COM} \times PA_{T} \times PA_{TSR}$$

Where: PAg = Unit Price Adjustment for Gradation.
PA_{AC} = Asphalt Binder Content Payment Adjustment.
PA_{COM} = Compaction Payment Adjustment.
PA_{T} = Thickness Payment Adjustment.
PA_{TSR} = TSR Payment Adjustment.

CHART A
ASPHALT BINDER CONTENT
PAYMENT ADJUSTMENT FACTOR

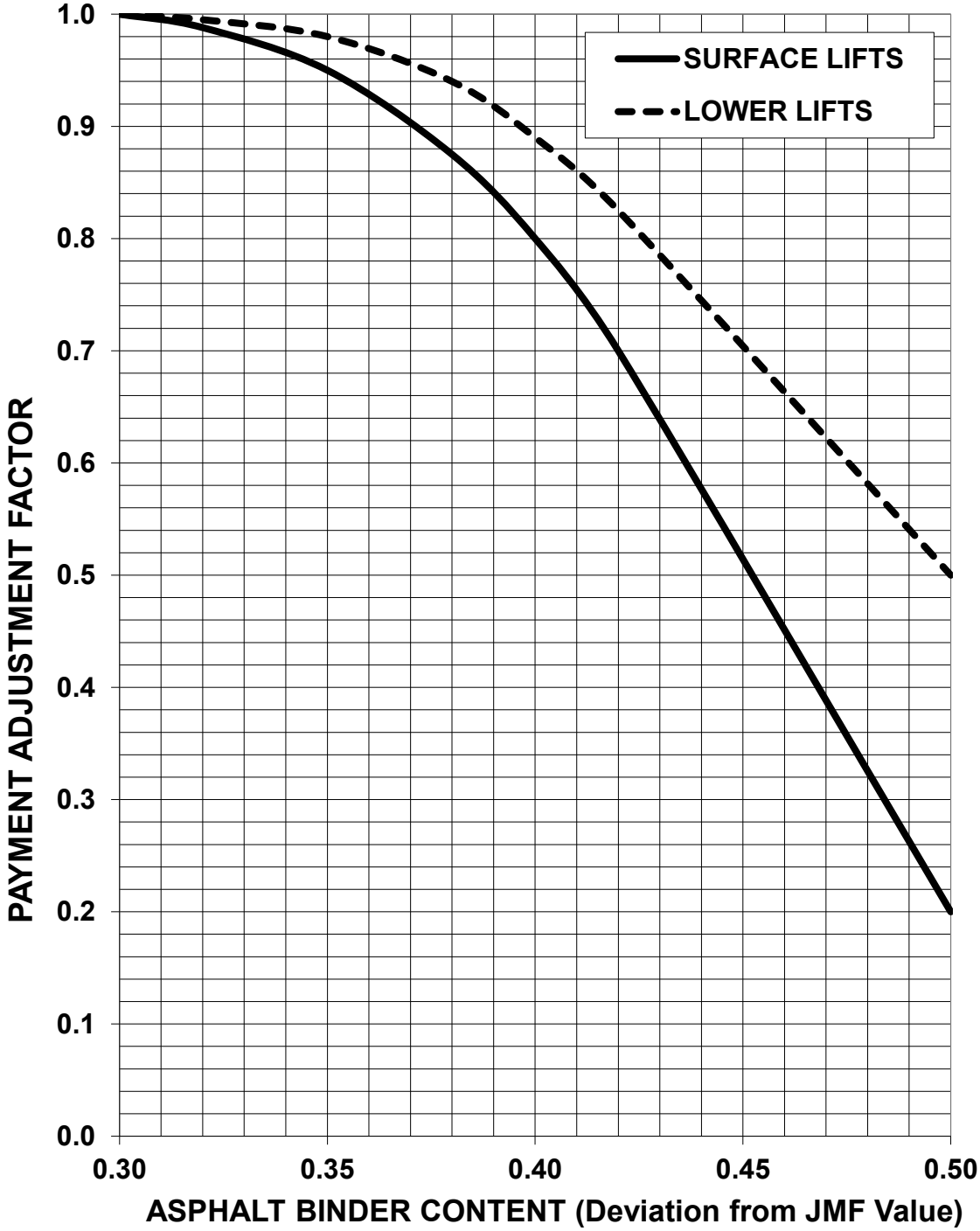
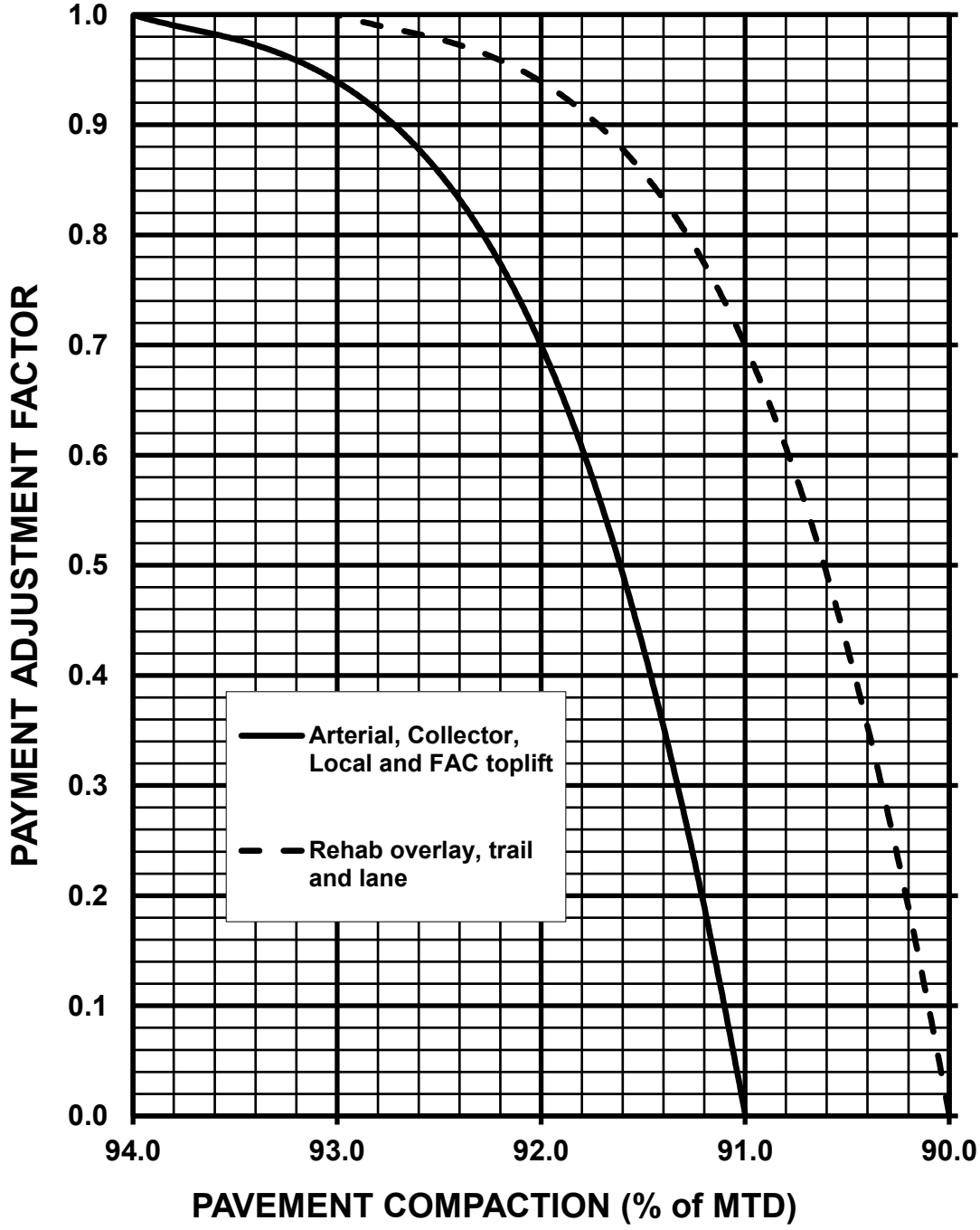


CHART B
COMPACTION
PAYMENT ADJUSTMENT FACTOR



END OF SECTION

HOT MIX ASPHALT CONCRETE TRAILS

1. GENERAL

1.1 Description

.1 This section specifies requirements for Hot Mix Asphalt (HMA) Concrete Trails (multiuse sidewalk) construction under a Quality Assurance Specification framework.

.2 The Work includes site preparation, site excavation, sub-grade preparation, supply of granular materials, granular materials placement, HMA supply, HMA placement, and clean-up, all to the requirements of this specification.

.3 This section includes the material requirements, material certification, quality control testing, quality assurance testing, product acceptance and rejection, reporting, and measurement and payment as required by the project.

.4 This section makes reference to other Sections with the City of Medicine Hat's Municipal Works Construction Specifications. In the case of a discrepancy between this section and other referenced Sections, this section will govern.

1.2 Related Sections

.1 Clearing and Grubbing – Section 02231.

.2 Sub-grade Preparation – Section 05010.

.3 Granular Base and Sub-base – Section 05020.

.4 Prime, Tack, and Fog Coats – Section 05110.

.5 Asphalt Binder – Section 05130.

.6 Performance Graded Asphalt Binder – Section 05135.

.7 Hot Mix Asphalt Concrete – Section 05140.

1.3 Definitions

.1 Acceptance is the process undertaken by the Engineer in which the available Quality Control and Quality Assurance test data is reviewed and the Work is inspected by Project Engineer to ensure that it meets the requirements of the specifications. Recommendation for acceptance may be provided by Project Engineer.

.2 Contractor is the Party that enters into an agreement to provide the required materials and to perform the Work on the project at a predetermined price or rate.

.3 Common Fill is all inorganic mineral deposits that are free from organic topsoil or loam, roots, rocks larger than 50 mm, and building debris. Excavation material is suitable if it conforms to the above and is approved in writing by the Engineer.

.4 Common Material are all inorganic mineral deposits, other than Rock, and includes partially cemented materials that can be ripped and excavated by a hydraulic excavator.

.5 Engineer as referred to in this specification, shall be Engineering Manager Municipal Works Department, City of Medicine Hat or designated representative.

.6 On-site Topsoil is the naturally occurring organic soil or loam material found in-place on the site surface.

.7 Project Engineer shall be City Engineer or designated representative or shall mean the licensed professional Engineer retained by the Developer.

.8 Quality Assurance (QA) is the planned and systematic activities, on the part of a purchaser or owner or designate, implemented in a quality system so that the quality requirements for a material, product and/or service are verified or confirmed.

.9 Quality Assurance Specification is a specification whereby the methods of construction are not completely defined and require Contractor QC and Project Engineer QA and Acceptance of the Work. The Contractor is responsible for QC and the Project Engineer will monitor the Contractor's control of the process that produces the Work. The Project Engineer will undertake QA and Inspection to accept the Work.

.10 Quality Control (QC) is the operational techniques and activities, on the part of a material, product or service provider, used to achieve and maintain the material, product or service to the required quality.

.11 Rock is all firmly cemented or solid mineral material that cannot, without drilling and blasting, be removed by a hydraulic excavator equipped with a straight cutting edge bucket with a minimum of 4 equally spaced high penetration teeth, and 0.5 cubic metres in capacity.

.12 Sub-soil is the layer of soil directly below the surface topsoil layer that contains the lower portion of the root zone, lacks the organic matter and humus content of topsoil, and is typically lighter in colour than the topsoil layer.

.13 Topsoil is natural, friable surface soil of organic character suitable for agricultural purposes that is free of objectionable quantities of sub-soil, roots, stones, and other deleterious substances, is normally referred to as the plough layer in agriculture soils, and is typically darker in colour than the sub-soil layer.

2. PRODUCTS

2.1 Materials

.1 Sub-grade to the requirements of Section 05010 Sub-grade Preparation 2.1 Materials but Fill Material will mean Common Fill and approved native material will mean Common Material.

.2 Common Fill as defined in 1.3.2.

.3 Common Material as defined in 1.3.3.

.4 Imported topsoil must be a homogeneous mixture of organic soil, loam, and compost that is easily friable, neither heavy clay nor of very light sandy nature, consisting of approximately 45% sand, 35% silt, 20% clay, with a pH value ranging from 6.5 to 7.5, and a minimum organic content of 6% that is approved for use by the Project Engineer in writing.

.5 Sub-base gravel to the requirements of Section 05020 Granular Base/Sub-base Preparation 2.1 Granular Sub-base.

.6 Base gravel to the requirements of Section 05020 Granular Base/Sub-base Preparation 2.2 Granular Base.

.7 HMA concrete to the requirements of Section 05140 Hot Mix Asphalt Concrete, and mix type S2.

2.2 Sampling and Testing

.1 The Project Engineer must have access to all production processes and materials used for the Work to monitor material quality as often as deemed necessary. Such inspection and testing will not in any way relieve the Contractor of the responsibility for meeting the requirements of the specifications.

.2 Quality Control:

.1 The Contractor will be totally responsible for production of materials and construction that meet all specified requirements.

.2 QC is the responsibility of the Contractor throughout every stage of the Work from utility locates to the final accepted product. Tests performed by the Project Engineer will not be considered as QC tests.

.3 All QC materials testing must be conducted by qualified agencies and personnel. The minimum qualification requirements are indicated in the City of Medicine Hat's "Guideline for Material Testing Agencies and Personnel Qualifications". The Contractor will bear the cost of all QC testing and consulting services.

.4 QC sampling and testing frequencies are indicated within the individually referenced Sections.

.3 Quality Assurance:

.1 Within this specification, certain requirements, limits and tolerances are specified regarding supplied materials and workmanship. Compliance with these requirements will be determined from QA testing and Acceptance inspections undertaken by the Project Engineer, as described in this section. All QA materials testing must be conducted by qualified agencies and personnel. The minimum qualification requirements are indicated in the City of Medicine Hat's "Guideline for Material Testing Agencies and Personnel Qualifications".

.2 QA testing is the responsibility of the Project Engineer and the Project Engineer will hire an independent materials testing laboratory to perform the required QA testing. The materials testing laboratory undertaking the QA testing must be independent of the materials testing laboratory undertaking QC testing for the Contractor.

.3 Initial QA testing will be undertaken free of cost to the Contractor. Unless otherwise indicated in the individually referenced Sections the QA results will be provided to the Contractor within 1 working day of the QA test being completed.

.4 QA tests to determine field compaction of the sub-grade preparation will be performed at a minimum frequency of 1 compaction test per 400 square metres.

.5 QA tests to determine field compaction the sub-base gravel and base gravel will be performed at a minimum frequency of 1 compaction test per 400 square metres. QA tests to determine the gradation and percent fracture will be performed at 1 test per 500 tonnes of material delivered to the site.

.6 QA test for HMA will be performed at the frequencies indicated in Section 05140 Hot Mix Asphalt Concrete.

2.3 Acceptance

.1 General:

.1 Within this section, certain requirements, limits, and tolerances are specified regarding supplied materials and workmanship. Compliance with these requirements will be determined from QA testing and acceptance inspections undertaken by the Project Engineer .

.2 The Contractor must provide Work conforming to the quality and tolerance requirements of the specifications. Where no tolerances are specified, the standard of workmanship must be in accordance with accepted industry standards.

.3 When required in writing by the Project Engineer, the Contractor must provide and operate a loaded single axle test vehicle loaded to 8,165 kg on the rear axel to proof roll the sub-grade, sub-base gravel, or granular base for rutting, weaving, and soft spots. At the Project Engineer's written discretion the Contractor may provide an alternative loaded test vehicle. Where proof rolling indicates areas that are defective, the Contractor must remove and replace the material with suitable compacted material.

.4 The Project Engineer will not accept materials or construction that do not meet the requirements of this section, unless indicated otherwise within other referenced Sections.

.2 Inspection Procedures

.1 The Contractor must provide safe, convenient access, acceptable to the Project Engineer, for sampling, testing, and inspection of the Work and must cooperate in the sampling, testing, and inspection process when requested to do so.

.2 Where QA tests reveal Work not in accordance with the contract requirements, the Contractor must pay the costs for all additional QA tests or inspections, as the Project Engineer may require, to verify the acceptability of the corrected Work.

.3 Inspection Stages

.1 The Work will be inspected by the Project Engineer, upon notification by the Contractor, for the completion of the following stages of the Work:

.1 Clearing and grubbing.

.2 On-site topsoil excavation.

.3 Sub-grade preparation.

.4 Granular sub-base and granular base preparation.

.5 HMA placement.

.2 The Project Engineer will undertake on going random inspections of the Work to monitor the progress of the Contractor and the quality and acceptability of the Work as it progresses. The frequency and timing of these inspections will be at the Project Engineer's sole discretion.

3. EXECUTION

.1 General:

.1 The Contractor must locate all underground utilities prior to commencing Work on the project and obtain written approval of the Project Engineer and the appropriated utility departments and utilities companies, prior to commencing excavation.

.2 Notify the Project Engineer and appropriate utility departments and utility companies 48 hours before starting excavations for utility line locates. Final excavation in the area of any utility line is to be done by hand or hydrovac, at the written discretion of the Project Engineer.

.3 Protect active utility lines exposed by excavation from damage, as instructed by the utility departments or utility companies.

.4 The Project Engineer will stake or flag the centreline or offset of the HMA concrete trail prior to commencement of construction, upon 2 working days notice from the Contractor. After initial location staking or flagging by the Project Engineer, the Contractor will be responsible for ensure the staking or flagging remains in place for as long as required for trail construction, as well as, protecting benchmarks and reference lines from damage. At the Contractor's cost, the Contractor must re-establish any staking or flagging, benchmarks, or reference lines disturbed or destroyed.

.5 Supply and install adequate barriers, fences, warning and construction signs, to the written approval of the Project Engineer, to prevent injury to the public. Maintain such barriers in good condition at all times during the Work.

.6 Construct temporary detours as necessary to perform the Work and maintain temporary detours until construction is completed.

.7 Location and drainage facilities for detours are subject to the written approval of the Project Engineer.

.8 If authorized in writing by the Project Engineer to use existing roads for detours, the Contractor must maintain such roads for duration of the contract and make good any damage resulting from the Contractor's use of those roads.

.9 The Contractor must protect all fences, buildings, sidewalks, curbs, paved areas, protected trees, shrubs, lawns, planted areas, and other features remaining as part of the final landscaping adjacent to the Work area from damage. The Contractor must repair, restore and make good, at the Contractor's cost, any and all damage to private and public property to the satisfaction of the property owner and the Project Engineer.

.2 Trail Site Clearing and Grubbing:

.1 To the requirements of Section 02231 Clearing and Grubbing and the following:

.1 Clear the trail site to a width of 1 m on both sides of the finished trail width, and to a height of 3 m. Trees at the trail edge must have all limbs facing the trail cut flush with a pole saw. Stripping and scaring of standing trees will not be permitted. All deadfall across the trail must be cut back to 600 mm outside the clearing width.

.2 Leaning and/or dead trees that in falling could reach the trail site must be felled away from the trail. The Project Engineer will flag all such trees.

.3 All trees presently growing on the site, which are to remain, must be protected to avoid any damage to them during construction operations. The Contractor must not excavate or use heavy equipment in proximity to trees that are to remain and must stay a minimum of 5 m away from the trunk or outside the drip line whichever is the larger value.

.4 The Contractor will be charged for any damage to trees that are to remain based on the value of the tree, as established by the International Society for Arboriculture Value Guide.

.5 Do not pull or rip out roots of trees that are to remain. If excavation through roots is required, excavate by hand and cut roots with a sharp axe.

.6 Stumps must be removed to a minimum depth of 600 mm below proposed finished grades.

.3 Tree and Plant Protection:

.1 Protect tops, trunks, and roots of existing plants on site that are intended to remain.

.2 Do not use heavy equipment within branch spread.

.3 Remove interfering branches and roots, without injury to trunks, only when specifically directed in writing by the Project Engineer.

.4 When existing grade around plants is lower than new finish grade perform re-grading by hand.

.4 On-Site Topsoil Excavation:

.1 Remove all weed and vegetation growth from areas to be stripped of on-site topsoil.

.2 Excavate on-site topsoil within the areas specified or as indicated in writing by the Project Engineer.

.3 Do not permit on-site topsoil to be mixed with sub-soils.

.4 Do not strip on-site topsoil under wet conditions.

.5 Do not disturb on-site topsoil within branch spread of trees or shrubs that are to remain.

.6 Stockpile on-site topsoil in locations approved in writing by the Project Engineer.

.4 Common Material Excavation:

.1 All Common Material is to be excavated to the elevations and dimensions specified on the drawings. Make changes in grade gradual and blend sloped areas into level areas with a smooth transition.

.2 Excavate all unsuitable material encountered from the construction area and stockpile on site in locations approved in writing by the Project Engineer.

.3 If the Project Engineer deems that the equipment used for excavation is inadequate in size or over-sized for Work area, the Contractor will replace with suitable equipment, as directed in writing by the Project Engineer.

.4 Rough grade to within 50 mm of the required sub-grade elevations but not uniformly high or low such that the exposed surface is clean cut.

.5 Excavated Common Material must be used within the site for backfilling and embankment operations unless directed otherwise in writing by the Project Engineer.

.6 Where Rock is encountered; any excavation Work for payment must be authorized by the Project Engineer in writing, prior to the start of excavation.

.5 Sub-grade Preparation:

.1 To the requirements of Section 05010 Sub-grade Preparation but 3.6 Testing is replaced with 2.2 Sampling and Testing herein.

.6 Sub-Base Gravel Course Construction:

.1 To the requirements of Section 05020 Granular Base/Sub-Base Preparation but 3.6 Testing is replaced with 2.2 Sampling and Testing herein.

.7 Base Gravel Course Construction:

.1 To the requirements of Section 05020 Granular Base/Sub-Base Preparation but 3.6 Testing is replaced with 2.2 Sampling and Testing herein.

.8 Hot Mix Asphalt Concrete:

.1 To the requirements of Section 05140 Hot Mix Asphalt Concrete and the following:

.1 Notify the Project Engineer 72 hours prior to HMA paving.

.2 Placed HMA when ambient temperature is above 7°C as issued by Environment and Climate Change Canada of the City of Medicine Hat. Monitor weather forecasts to determine optimum paving schedule.

.3 Apply HMA in 1 full lift to achieve a total compacted thickness of 75 mm to the specified elevations and grades.

.4 The elevation of the finished HMA surface is designed to be 50 mm higher than adjacent grades.

.5 The rollers used to compact the HMA must include at least 1 pneumatic-tired roller.

4. MEASUREMENT AND PAYMENT

.1 Where the Unit Price for an item indicated in the contract is stipulated to be by the square metre the area of the individual item will be determined in the field by the Project Engineer and it will be the top surface area determined from horizontal measurements with no allowance for uneven or sloping ground regardless of the item being measured.

.2 Where the Unit Price for an item indicated in the contract is stipulated to be by the tonne the mass of the individual item must be scaled and recorded by the Contractor on duplicate weight slips. Weight slips must be supplied at the time of delivery and a copy supplied to the Project Engineer. The weight scale must be inspected and certified by Weights and Measures Inspection Services of the Federal Department of Consumer and Corporate Affairs at the Contractor's expense prior to the supply of any materials and as often as the Project Engineer may direct in writing.

.3 The Unit Price for items identified in the contract will be full compensation for all materials, labour, tools, equipment and incidentals necessary to complete the Work in accordance with these specifications.

.4 Payment for underground utility location and excavation, supply and installation of adequate barriers, fences, warning and construction signs, construction of temporary detours, clearing and grubbing, tree and plant protection, and proof rolling the sub-grade, sub-base gravel and base gravel is considered incidental to the Work and no separate payments will be made.

.5 On-site topsoil excavation will be paid by the square metre of area stripped regardless of the depth of topsoil.

.6 Common Material excavation will be paid by the cubic metre.

.7 Sub-grade preparation will be paid by the square metre regardless of the depth of sub-grade preparation.

.8 Sub-base gravel and base gravel will be paid by the tonne for materials incorporated into the Work.

.9 HMA will be paid for in accordance with Section 05140 including any and all payment adjustments.

END OF SECTION

ASPHALT MILLING

1. GENERAL

1.1 Description

.1 This work shall consist of removal of asphalt concrete pavement by cold planning in accordance with these specifications and to the specified lines, grade, and cross-section shown on the drawings or as designated by the Engineer.

.2 The sequence of the locations to be milled will be determined by the Engineer.

1.2 Definitions

.1 Reclaimed Asphalt Pavement (RAP): The material produced as a result of cold milling shall be defined as Reclaimed Asphalt Pavement (RAP).

2. EQUIPMENT

2.1 General

.1 The equipment for removing the existing asphalt pavement surface shall be a cold planning machine specifically designed for automatically controlled profiling.

.2 Automatic grade and slope shall be provided for accurately establishing profile grades at each edge of the machine by referencing from the existing asphalt pavement or an independent grade reference, where required, or be capable of automatically maintaining a designated cross slope from a single reference.

.3 The machine will be self-propelled and shall have sufficient power, traction and stability to maintain an accurate depth of cut.

.4 The cutting head shall be capable of full drum width milling of a 75 mm thickness of asphaltic concrete in a single pass.

.5 The equipment shall be equipped with means to effectively control dust generated by the cutting operation.

.6 Hauling equipment shall be available to receive milled material directly from the milling machine. Personnel shall be provided to insure that all cutting are removed from street surface within 30 m of milling operation and swept within 150 m. Stockpiling of planed material (RAP) shall not be permitted on the project site.

.7 Equipment for removing any loose material during the sweeping operation shall have the capability to pick the material up off the milled and/or adjacent roadway and be able to unload onto the hauling equipment.

.8 The machine shall be capable of producing a minimum coverage of 2,000 square meter per hour while planing a minimum of 15 mm of the existing pavement per pass and be able to cut flush to all gutters, curb walls, manholes, valves, catch basins or other obstructions within the paved area.

3. EXECUTION

3.1 Construction

.1 The Contractor will obtain and review the most recent Temporary Traffic Control Manual available on the City of Medicine Hat website.

.2 The Contractor shall provide all necessary labour, materials and equipment to load the RAP into dump trucks supplied by him and hauled to a disposal area designated by the Engineer.

.3 Sufficient passes, or cuts, shall be made such that all irregularities or high spots are eliminated, and that 100 percent of the surface area is planed to the design grade or to the satisfaction of the Engineer.

.4 The number of passes required to achieve the specified width and depth shall be determined by the Contractor.

.5 If the milled surface is to be used as the final wearing surface, the texture produced by the planing operation should be characterized by uniform, discontinuous longitudinal striations or other patterns which will, in the opinion of the Engineer, provide a satisfactory riding surface and skid resistance.

.6 The milling is to expose frames of all manholes, water valves, survey monuments, power and telephone poles and water valves to the required depth of milling.

.7 Dust produced shall be controlled to a level acceptable to the Engineer.

.8 When existing asphalt pavement removal is to be completed across the entire roadway width, it shall be completed to a uniform termination point in any given working day. For divided roadways, the interpretation of “entire roadway width” shall be that portion of the roadway facility associated with the movement of traffic in one direction. At the point of daily termination of removal operations, abrupt changes in the roadway surface profile shall be avoided. The longitudinal transition shall be a maximum of 25 mm vertically per meter.

.9 In the event the entire roadway of pavement along a section has not been milled by the end of the working period, resulting in a vertical longitudinal face, the maximum deviation between the two surfaces should not exceed 40 mm.

.10 Vertical cuts along a gutter line will be allowed at the end of the working period. Should the depth of cut be 75 mm or greater, proving hazardous to traffic, suitable signing and/or warning devices shall be provided by the Contractor.

.11 Existing asphalt pavement that cannot be removed by the milling equipment because of physical or geometrical restraints should be removed by other methods suitable to the Engineer.

.12 All RAP shall be loaded directly onto trucks from the milling machine and hauled to the designated stockpile site.

.13 The milling equipment shall be operated and maintained in such a manner that tearing and breaking out of the underlying and adjacent material is minimized.

.14 The resultant milled roadway surface shall be swept clean immediately after the removal of the milled material, and in no case should the sweeping operation be more than 100 meters behind the milling operation.

.15 Any distress of the newly milled surface caused by the milling which may constitute a driving hazard, shall be promptly repaired to the satisfaction of the Engineer.

.16 The contractor shall at all times minimize contamination of the RAP with granular or deleterious material.

.17 The Contractor shall make necessary allowances for drainage of water that may pond in areas where the milled sections have not been paved.

.18 Certain streets may require night planing or weekend planing as designated by the Engineer. Upon completion of planing, the surface shall be left in such condition that it can be reopened to traffic as soon as the loose materials have been removed.

3.2 Ownership

.1 The Contractor shall assume ownership of the RAP. The Contractor shall haul and place the RAP at an Engineer approved stockpile area on site or disposed of or stockpiled in a location determined by the Contractor.

END OF SECTION

PAVEMENT ROUTING, CRACK CLEANING AND SEALING

1. GENERAL

1.1 Description

.1 This Section specifies requirements for repairing cracks in existing pavements that are not being overlayed within one year. The work consists of routing, cleaning and drying cracks and sealing them with crack sealant between the limits shown on the plans or as directed by the Engineer.

2. PRODUCTS

2.1 Materials

.1 Emulsified asphalt to CAN/CGSB-16.2, grade SS-1

.2 Cutback asphalt to CAN/CGSB – 16.1, grade RC-250.

.3 Hot-poured rubberized asphalt to be Beram 195 LM, Husky 1611, Koch 9030, Lafrentz Road Saver 522 or approved equal.

.4 Aggregates for crack filling shall meet the following requirements:

Sieve Size (microns)	Sand-Asphalt slurry using emulsion % Passing	Sand – asphalt mix using cutback asphalt % Passing
2 000	100	100
425	30 – 55	-
180	12 – 30	-
075	3 - 12	0 - 8

.5 Sand equivalent to ASTM D 2419, not less than 45%.

.6 Mixing water shall be potable.

2.2 Mixes

.1 Sand-asphalt slurry mixes shall be mixed to the following proportions:

.1 50 Kg. of aggregate.

.2 10 to 16 litres of asphalt material.

.3 Potable water to produce a uniform mix of consistency to achieve full penetration into pavement cracks.

2.3 Blotting Agents

.1 When directed by the Engineer, the Contractor shall supply one of the following blotting agents:

.1 Screened sand with a maximum topsize of 2 mm.

.2 Cement or Flyash.

3. EQUIPMENT

3.1 General

.1 The Contractor shall supply all equipment necessary for completion of the Work including but not limited to the melting kettle, air compressor, manual pouring cones, mechanical rotary routers specifically designed for following random irregular cracks without tearing, chipping or spalling edges and capable of producing the specified rout cross-section.

.2 Router and Cutter Bits

.1 Router shall be flexible and portable as required to follow random cracking.

.2 Router shall have sharp cutter bits that will cut a minimum size groove 20 mm wide and 10 mm deep.

.3 Compressed Air Equipment

.1 Compressor shall have a capacity of 2 m^3/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.

.4 Hot air lance as approved by the Engineer.

.5 Portable oil jacketed type double boiler melter with a mechanically operated agitator, and separate thermometric controls and gauges for sealant and heat transfer of oil shall be used when applying rubberized asphalt. A tar kettle may be used for catalytic asphalt.

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

4. EXECUTION

4.1 Preparation

.1 The Contractor will obtain and review the most recent Temporary Traffic Control Manual available on the City of Medicine Hat website.

.2 A review of surfaces to be crack sealed shall be undertaken with the Engineer to establish physical limits of cracks to be sealed.

.3 Remove existing sealers and loose materials as directed by the Engineer.

.4 Rout designated cracks to a minimum width of 25 mm and a depth of 35 mm to 50 mm using mechanical rotary routers. Router cut shall be perpendicular to the pavement surface.

.5 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.

4.2 Crack Filling

.1 Perform pavement crack filling only when ambient air temperature is above 10ºC and when daily low temperatures do not fall below 5ºC.

.2 Do not perform pavement crack filling when there is rain in the weather forecast.

.3 Sealant shall be melted in accordance with the Manufacturer's instructions. Diluted, overheated or burned materials shall be removed from the work site and suitably disposed of.

.4 Melted sealant shall be placed into routed cracks in accordance with the 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.

.5 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.

.6 Sealant spilled on pavement surfaces shall be removed and the area sprinkled lightly with fine sand.

4.3 Cleanup

.1 Clean all sidewalks of debris blown from routed cracks. Sweep debris onto roadway for removal by street sweepers.

END OF SECTION

ADJUSTMENT OF APPURTENANCES

1. GENERAL

1.1 Description

.1 This section refers to the adjustment of Valves and Manholes within the roadways to be paved.

1.2 Related Work

.1 Section 05140 – Asphalt Concrete.

2. PRODUCTS

2.1 Valve Box Risers

.1 Valve box extensions shall be 75, 100 or 150 mm cast iron conforming to ASTM A48 Class 25 and are to be completely coated with an asphaltic type varnish to prevent corrosion.

2.2 Gas Valves

.1 Contact the City of Medicine Hat Gas Department for arranging adjustments to Gas Valves.

2.3 Manhole Grade Rings and Block

.1 Precast grade rings and blocks for manhole grade adjustment shall conform to ASTM C478 and C139, respectively.

.2 Infra-Riser Rubber and steel riser adjustment rings.

2.4 Mortar

.1 Mortar shall be Sulphate resistant ASTM Type HS producing a minimum strength of 10MPa.

3. EXECUTION

3.1 General

.1 For asphalt base course, adjustments to valves and manholes shall be made to the asphalt base course elevation.

.2 For asphalt surface course, adjustments to Valves and Manholes shall be made to the asphalt surface course elevation.

.3 Where top/final lift of asphalt is not placed in the same year as the base lift, manhole frames/covers and other surface appurtenances shall be set to the interim asphalt grade.

.4 Where top lift of asphalt is to be placed in the same year as the base lift, manhole frames/covers and other surface appurtenances shall be set to the final asphalt grade. Projecting manholes and valves shall be ramped at 1:40 prior to placing final asphalt lift.

.5 Final adjustments shall be made to the final Asphalt Surface Course elevation using adjustment rings only prior to the placement of the final asphalt lift at FAC.

3.2 Valve Boxes

.1 The contractor shall shorten or lengthen the boxes and stems as required and block the boxes to prevent any settlement. The adjustments shall be so made that the valves operate effectively.

.2 If the top box fails to move, risers can be used to bring it to grade.

.3 The Contractor shall replace any valve top box that becomes broken during adjustment at his expense.

3.3 Manholes

.1 Manholes shall be adjusted so that the cover conforms to the required elevation. All adjustments are to be made with grade rings firmly set in position. All bearing loads of the manhole frame to the manhole slab top shall be evenly distributed.

.2 Raise existing manholes frames and covers and catch basin frames and grates to final design elevation, using adjusting rings as per Clause 2.2.2.

.3 If adjustment exceeds more than 300mm the adjustment shall be made using a new manhole barrel c/w ladder rung.

.4 The final 25mm shall be adjusted utilizing a infra riser rubber or neoprene adjustment ring directly beneath the frame and cover assembly. Sloped adjustment rings shall be used to match the roadway profile.

.5 Wood shims shall not be used to level the adjustment rings or frames.

.6 Metal shims shall be used only if written approval is obtained from the Engineer.

.7 Depth from top of Manhole covers to first ladder rung shall not exceed 600mm. Install additional ladder rungs as necessary or as directed by the Engineer.

3.4 Backfill

.1 Should any backfill be required around the valve box or manhole below the elevation of the road base course surface, 10 MPa concrete (leancrete) shall be installed , or granular base shall be used and compacted in place.

END OF SECTION

CONCRETE AND ASPHALT REMOVAL AND DISPOSAL

1. GENERAL

1.1 Protection

.1 Protect existing items designated to remain. In the even of damage to such item, immediately replace or make repairs to approval of the Engineer at no cost to the Owner.

2. EXECUTION

2.1 Equipment

.1 The Contractor will obtain and review the most recent Temporary Traffic Control Manual available on the City of Medicine Hat website.

.2 Trucks must be loaded in such a manner that no spillage occurs, and care must be taken to prevent dragging construction materials onto improved streets.

.3 Haul routes must be kept clear and free from dust by grading and sprinkling with moisture whenever, if in the opinion of the Engineer, conditions warrant this treatment.

.4 All excavating and hauling equipment must be equipped with suitable muffling systems.

2.2 Preparation

.1 Inspect the 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 the site.

.3 Notify Utility companies before starting work in accordance with Section 01500.

3.3 Removal of Existing Concrete

.1 Remove existing curbs, gutters, and sidewalks and other structures shown on the drawings or as directed by the Engineer.

.2 Cut existing concrete neatly, and load and haul debris to a designated disposal area or approved facility.

.3 Avoid damage to adjacent concrete surfaces not scheduled for removal. Damages will be the responsibility of the Contractor.

.4 Properly sign and barricade areas of removed concrete areas.

.5 Deter the public from access to the removed concrete areas until the new concrete has been replaced and hardened.

3.4 Removal of Existing Asphalt

.1 Remove existing pavement structure as indicated on the drawings or as identified by the Engineer.

.2 Do not disturb adjacent items designated to remain in place.

.3 In removal of pavement:

.1 Square up adjacent surfaces to remain in place by saw cutting or other methods approved by the Engineer.

.2 Protect adjacent joints and load transfer devices.

.3 Protect and stockpile underlying granular materials for re-use as directed by the Engineer.

3.5 Disposal

.1 Removed concrete and asphalt shall be separated and disposed at the City of Medicine Hat Landfill or alternative Engineer approved site.

3.6 Restoration

.1 Upon completion of the work, remove debris, trim surfaces and leave work site clean.

.2 Reinstate areas and existing works to original or better condition.

END OF SECTION

SIDEWALK CONSTRUCTION

1. GENERAL

1.1 Description

.1 This section specifies requirements for construction of sidewalks, curbs and gutters.

1.2 References

.1 CAN/CSA-A23.1-04, Concrete Materials and Methods of Concrete Construction.

.2 CAN/CSA-A23.2-04, Methods of Test for Concrete.

.3 CAN/CSA-A3000-08, Portland Cement.

.6 CAN3-A266.4-M78, Guidelines for the Use of Admixtures in Concrete.

.7 CGSB 51-GP-51M-81, Polyethylene Sheet for Use in Building Construction.

.8 ASTM C109-08, Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 inch or 50 mm Cube Specimens).

.9 ASTM C309-07, Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

.10 CSA G30.18-M92, Billet Steel Bars for Concrete Reinforcement.

2. PRODUCTS

2.1 Materials

.1 Portland cement: to CAN/CSA-A5, Type HS sulphate resistant.

.2 Water: to CAN/CSA-A23.1.

.3 Aggregates: to CAN/CSA-A23.1.

.4 Air entraining admixture: to CAN3-A266.1.

.5 Chemical admixtures: to CAN3-A266.2. Engineer to approve accelerating or set retarding admixtures during cold and hot weather placing.

.6 Curing compound: to CAN/CSA-A23.1 white and to ASTM C309-07, Type 1-D with fugitive dye.

.7 Polyethylene film 0.15 mm: to CGSB 51-GP-51M.

.8 Reinforcement for Concrete: CSA G30.18-M92.

2.2 Concrete Mixes

.1 Proportion normal density concrete in accordance with CAN/CSA-A23.1, to give following properties for all concrete:

.1 Cement: Type HS Portland cement.

.2 Minimum compressive strength at 28 days: 25.0 MPa.

.3 Minimum cement content: 300 kg/m^3 of concrete.

.4 Maximum water cement ration: 0.45

.5 Class of exposure: A.

.6 Nominal size of coarse aggregate: 20 mm.

.7 Slump at time and point of discharge: 30 mm to 80 mm.

.1 No water adjustment is allowed to the delivered concrete after 1 hour of the concrete batch time.

.8 Air content: 5 to 8%.

2.3 Curing Compound

.1 Curing compound shall conform to ASTM specifications C309-07 Type 1-D or 2, and be approved by the Engineer.

.2 The compound shall be sufficiently free from permanent colour to result in no pronounced change in colour from that of natural concrete.

.3 The compound shall, however, contain a dye of colour strength sufficient to render the film distinctly visible on the concrete for a period of at least four (4) hours after application.

2.4 Sealing Solution

.1 The sealing solution shall be a mixture of 50% boiled linseed oil and 50% kerosene or varsol.

3. EQUIPMENT

3.1 General

.1 All equipment necessary for the proper handling of materials, batching, mixing, placing, finishing and curing of concrete pavement shall be on the project in good working condition. Throughout the construction of the project, the Contractor shall maintain sufficient, adequate equipment in good, clean, working condition, to assure the proper execution of the work.

3.2 Mixing Equipment

.1 Concrete may be mixed at the site of construction, at a central point, or wholly or in part in truck mixers. Each mixer shall be an approved type and shall have attached, prominently, a manufacturer's plate showing the capacity of the drum in terms of volume of mixed concrete and the speed of rotation of the mixing drum or blades.

3.3 Forms

.1 Forms, either of steel or wood shall conform to the shape, lines and dimensions of the concrete as called for on the drawings.

.2 Forms shall be substantial and sufficiently tight to prevent leakage of mortar; they shall be properly braced or tied together so as to maintain position and shape.

.3 The inside of the forms shall be smooth, cleaned and coated with non staining mineral oil or other approved material.

3.4 Additional Equipment

.1 The Contractor shall furnish all other tools and supplies necessary for the proper execution of the Work.

4. EXECUTION

4.1 General

.1 Notify the Engineer 24 hours prior to commencement of operation.

4.2 Testing and Inspection

.1 The Owner may engage a CSA certified testing company to confirm the compliance to the specifications.

.2 The Contractor shall allow access and provide material for all tests by the Owners testing agency.

.3 The testing company is only authorized to report results of the tests and is not authorized to approve the construction. Any questions raised by the testing will be directed to the Owner or the Owners authorized representative.

.4 Testing frequency shall be at 1 test per 50 cubic meters or 1 test per day on placed concrete whichever is greater.

.5 The cost of further testing will be at the expense of the Contractor if the concrete does not meet the specification criteria in the initial tests.

.6 Remedial action shall be at no expense to the Owner or the Engineer.

Base Construction

.1 Sidewalks and curb & gutter base material shall consist of cutting the existing sub-grade or filling with native material or if the contract specifies uniform backfill, specified granular materials will be installed to the designed grades as directed by the Engineer. The sidewalk base shall be compacted to a minimum of 100 % (standard Proctor maximum dry density) with a moisture content of plus / minus two percent (± 2%) of the specified optimum moisture content.

.2 When directed by the Engineer to stabilized soft areas, or as shown on the drawings granular base material shall be placed and compacted to the following requirements.

.1 Granular fills will be made up of 150 mm layers and consolidated with approved compaction equipment which will produce a minimum of 100% (standard Proctor maximum dry density). The fill shall be moisture conditioned, by drying or adding water, to obtain an in-place moisture content between the optimum moisture content and two percent below the specified optimum moisture content (-2% to optimum).

.2 Gradation to be within the following limits when tested to ASTM C-117 with sieve sizes to CAN/CGSB 8.2-M88, and to have a smooth curve without sharp breaks when plotted on a semi-log grading chart.

Sieve Size (microns)	Percent Passing By Weight
20 000	100
16 000	84 - 94
10 000	63 – 86
5 000	40 – 67
1 250	20 – 43
630	14 – 34
315	9 – 26
160	5 – 18
80	2 - 10

4.4 Dowelling

.1 Steel dowels to CSA G 30.18.M92, clean, plain, free from flattened or burred ends, free from rust, scale or other substances that prevent the bonding of the concrete to the reinforcement, uncoated.

.2 10 mm steel dowels shall be installed at a minimum of 1 dowel per 0.45m when tying into existing concrete structures.

4.5 Reinforcement

.1 Reinforcing bars, tie bars to CSA G30.18-M92 Grade 300, billet-steel, deformed bars, uncoated.

.2 Place reinforcing bars in lane crossings or as detailed.

.3 Clean reinforcing bars free of loose rust and mill scale.

4.6 Delivery

.1 When a truck mixer or agitator is used for transporting concrete, the concrete shall be delivered to the site of the work and discharge shall be completed within one and one-half (1½) hours after the introduction of the mixing water to the cement and aggregates (otherwise known as batch time). If the concrete has not been discharged by within one and on-half (1½) hours from batch time, the concrete shall be retested for slump, air and compressive strength. The concrete shall be rejected if any of the mix properties do not conform to the specified requirements.

.2 No water or chemical admixtures shall be added to the concrete mixture after one (1) hour from batch time.

.3 At no time will the concrete be accepted if the discharge has not been completed within two (2) hours from the batch time.

4.7 Placement and Consolidation

.1 All concrete sections to be constructed in accordance with attached detailed drawings.

.2 Placing shall be continuous between planned transverse joints without the use of intermediate bulkheads. If concrete pavement is interrupted for more than 30 minutes, transverse construction joints shall be made.

.3 The concrete shall be placed or subsequently distributed to an even depth.

.4 All concrete construction shall be vibrated by means of a vibrating screed or internally by means of a poker or pencil vibrator which shall not exceed fifty (50) millimetres in diameter.

4.8 Cold Weather Requirements

.1 Do not place concrete when the ambient air temperature is below 5 degrees Celsius, unless the following requirements are met:

.1 Preheat water and aggregates as well as reinforcement, forms and the ground.

.2 Concrete when deposited, shall have a temperature of not less than 4 degrees Celsius nor more than 27 degrees Celsius under warm weather conditions. Concrete shall be covered and maintained at a temperature of at least 10 degrees Celsius for not less than seventy two (72) hours after placing, or until the concrete has thoroughly cured.

.3 Do not use calcium chloride, except with the written permission of the Engineer and then only with normal Portland cement and in quantities less than 2% by weight. Close control of calcium chloride quantities and careful mixing is required.

4.9 Concrete Finishing

.1 After placing, concrete shall be finished as per the relevant sections of Clause 22 of CAN/CSA A23.1-04. Excess finishing is to be avoided. No plaster coat will be allowed. Adding water to the surface of the concrete to assist with finishing will not be allowed.

.2 Prior to final finishing, the surface grade of concrete slabs shall be checked to an accuracy of plus or minus five (5) mm with a three (3) metre long metal straight edge. The straight edge shall be drawn across the surface in a scraping motion to identify deviations for immediate correction. The straight edge shall be advanced one-half its length for successive checks.

.3 Provide 15 mm deep by 5 mm wide contraction joints every 1.5 m on centre by means of marking tool or other approved method.

.4 Finish the outside edges of sidewalks and each edge of joints with 50 mm wide edging tool having a 6 mm radius.

.5 A broom finish shall be obtained by the use of a stiff, coarse fibre broom. A tined finish shall be obtained by the use of a device having irregularity spaced wire tines with an average spacing of 12mm to 18mm. The device shall be dragged transversely across the surface to form ridges. Transverse texturing shall be delayed until the concrete is sufficiently hard to retain the ridges.

.7 Apply curing compound to finished surface immediately after floating in accordance with manufacturer's instructions.

.8 The Contractor shall always have available material to protect the surface of the plastic concrete from damage from the rain. The materials shall consist of burlap, cotton mats, waterproof paper or plastic sheeting. Protection shall be employed when rain, sufficient to mar the texture of the concrete surface is expected. The decision of the Engineer in this regard shall be final.

.9 The Contractor is responsible to ensure the surface of the concrete is not vandalized during set-up. Any damaged surface must be repaired, or replaced, to the satisfaction of the Engineer.

4.10 Concrete Curing

.1 As soon as practical, after the texturing operation is complete, the entire pavement surface, including exposed sides, shall be cured by protecting it against loss of moisture, rapid temperature change and mechanical injury, in accordance with the requirements of Clause 21 of CSA A23.1-04 for Class C-2 concrete.

.2 The Contractor shall be responsible for taking all necessary measures to protect freshly placed concrete from adverse weather conditions, including hot weather, wind, rain, sleet, snow and cold weather, to the satisfaction of the Engineer. Concrete shall be adequately protected in accordance with the requirements specified in CAN/CSA-A23.1 – 04, Section 21.2.

.3 When Polyethylene film sheets (light coloured) or waterproof paper sheets are used, the sheets shall be long enough to cover the entire width and edges of the section and shall be lapped a minimum of 300mm at joints. The sheets shall be adequately weighed to prevent displacement or billowing due to wind.

.4 When white liquid membrane forming curing compounds are employed, the compound shall be applied to exposed surface and edge of the concrete section following the final texturing operation, after all free bleed water has evaporated or been removed from the surface. Complete and uniform coverage, at a rate of three (3) to four (4) m²/L shall be required. The compound shall be agitated to prevent pigment from settling.

.5 If the curing compound method of curing is used in combination with sawn control joints, provisions shall be made to cure and protect the exposed faces of the cleaned joint.

.6 When concrete has been placed in cold weather and the air temperature is expected to drop below 5 C, then polyethylene sheets, insulated curing blankets or other suitable material shall be placed beside the concrete members. Whenever the temperature is expected to reach the freezing point, during the day or night, the protective material shall be spread over the concrete surface and weighted to prevent movement to protect the concrete from freezing. Curing shall continue until the cumulative number of days, not necessarily consecutive, or fraction thereof, during which the temperature of the air in contact with the concrete is above 10 C, has totalled a minimum of seven (7) days. Alternatively, if compressive test of cylinders cured under field conditions achieve at least 70 percent (70%) of the specified compressive strength, curing may be discontinued.

.7 Concrete placed in cool weather shall experience a minimum 30 day air drying period, following final curing, before the first application of de-icing salts.

.8 Concrete damaged as a result of inadequate protection against weather conditions shall be removed and replaced by the Contractor at his own expense.

4.11 Tolerances

.1 Meet the following criteria for exposed concrete surfaces:

.1 Trueness of surface: 6 mm maximum deviation in 3 m length.

.2 Elevation: 10 mm maximum deviation from given elevation.

.3 Alignment: 25 mm maximum deviation from given alignment.

.4 Crossfall: 2.0% +/- 0.2%

4.12 Backfill

.1 Backfilling shall be completed by the Contractor on all the concrete poured.

.2 Backfilling shall commence within 10 days, but no sooner than 7 days from the day the concrete was finished, or as directed by the engineer.

3 Material placed behind sidewalks or curb and gutter shall be compacted to a minimum 90% of Standard Proctor Density. Material shall be placed to the full height of concrete unless otherwise specified by the Engineer.

.4 Where landscaping is required, leave backfill 100 mm below finished grade to allow for topsoil and Sod.

4.13 Opening to Traffic

.1 In no case shall traffic or construction equipment be allowed on the concrete until the concrete has reached a minimum in situ compressive strength of 20 MPa, or has been allowed to cure for a minimum of seven (7) days.

5. FINAL INSPECTIONS AND ACCEPTANCE

5.1 Inspection

.1 All workmanship and all materials furnished and supplied under this Specification are subject to close and systematic inspection and testing by the Engineer including all operations from the selection and production of materials through final acceptance of the specified work. The Contractor shall be wholly responsible for the control of all operations incidental thereto notwithstanding any inspection or approval that may have been previously given. The Engineer reserves the right to reject any materials or works which are not in accordance with the requirements of this Specification.

5.2 Access

.1 The Engineer or a designate shall be afforded full access for the inspection and control testing of concrete and constituent materials, both at the site of work and at any plant used for the production of concrete, to determine whether the concrete is

being supplied in accordance with this Specification.

5.3 Thickness

.1 At the opinion of the Engineer, the thickness of concrete members may be determined by coring sections representing each day's pour and determining the depth of each core by average measurements of the core.

.2 Members found deficient in thickness by more than 5 percent shall be paid for at the reduced price as follows:

Deficiency in Concrete Thickness (mm)	Payment, Percentage Contract Unit Price
5	100
15	75
20	50
25 or Greater	Removal and Replace

.3 The cost of the initial quality assurance core testing shall be paid for by the Engineer. Additional cores requested by the Contractor to determine the extent of areas deficient in thickness shall be paid for by the Contractor.

5.4 Compressive Strength

.1 Payment adjustments for compressive strength are as follows:

Average Compressive Strength	Payment Adjustment Factor
Compliant or greater	1.00
24.0 MPa to 24.9 MPa	0.95
23.0 MPa to 23.9 MPa	.090
Below 23.0 MPa	Reject (Note 1)

Note 1: Subject to removal and replacement at the discretion of the Engineer.

5.5 Air Content

.1 Payment adjustments for air content are as follows:

Average Air Content	Payment Adjustment Factor
5% or greater	1.00
4.59% - 4.9%	0.90
4.09% – 4.4%	0.80
Below 4.0%	Reject (Note 1)

Note 1: Subject to removal and replacement at the discretion of the Engineer.

5.6 Final Acceptance

.1 In the event where the compressive strength of the test cylinders, low air entrainment, deficient slump, improper compaction of the concrete base, poor finishing or crossfall, trueness of surfaces, elevation and alignment tolerances for any portion of the work does not meet the requirements specified herein, the City of Medicine Hat and its representatives, at their discretion may require that the portion (s) deemed deficient be completely removed and replaced at the expense of the Contractor.

END OF SECTION

EXTRUDED CONCRETE

1. GENERAL

1.1 Description

.1 This section specifies to extruded concrete pavements, sidewalk, curbs and gutters and other related work constructed through the use of slip form machines (extruders).

1.2 References

.1 CAN/CSA-A23.1-04, Concrete Materials and Methods of Concrete Construction.

.2 CAN/CSA-A23.2-04, Methods of Test for Concrete.

.3 CAN/CSA-A3000-08, Portland Cement.

.4 CAN3-A266.1-M78, Air-Entraining Admixtures for Concrete.

.5 CAN3-A266.2-M78, Chemical Admixtures for Concrete.

.6 CAN3-A266.4-M78, Guidelines for the Use of Admixtures in Concrete.

.7 CGSB 51-GP-51M-81, Polyethylene Sheet for Use in Building Construction.

.8 ASTM C109-08, Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 inch or 50 mm Cube Specimens).

.9 ASTM C309-07, Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

.10 CSA G30.18-M92, Billet Steel Bars for Concrete Reinforcement.

2. PRODUCTS

2.1 Materials

.1 Portland cement: to CAN/CSA-A5, Type HS sulphate resistant.

.2 Water: to CAN/CSA-A23.1.

.3 Aggregates: to CAN/CSA-A23.1.

.4 Air entraining admixture: to CAN3-A266.1.

.5 Chemical admixtures: to CAN3-A266.2. Engineer to approve accelerating or set retarding admixtures during cold and hot weather placing.

.6 Curing compound: to CAN/CSA-A23.1 white and to ASTM C309-07, Type 1-D with fugitive dye.

.7 Polyethylene film 0.15 mm: to CGSB 51-GP-51M.

.8 Reinforcement for Concrete: CSA G30.18-M92.

2.2 Concrete Mixes

.1 Proportion normal density concrete in accordance with CAN/CSA-A23.1, to give following properties for all concrete:

.1 Cement: Type HS Portland cement.

.2 Minimum compressive strength at 28 days: 25.0 MPa.

.3 Minimum cement content: 300 kg/m^3 of concrete.

.4 Maximum water cement ration: 0.45

.5 Class of exposure: A.

.6 Nominal size of coarse aggregate: 20 mm.

.7 Slump at time and point of discharge: maximum 30 mm.

.1 No water adjustment is allowed to the delivered concrete after 1 hour of the concrete batch time.

.8 Air content: 5 to 8%.

2.3 Curing Compound

.1 Curing compound shall conform to ASTM specifications C309-07 Type 1-D or 2, and be approved by the Engineer.

.2 The compound shall be sufficiently free from permanent colour to result in no pronounced change in colour from that of natural concrete.

.3 The compound shall, however, contain a dye of colour strength sufficient to render the film distinctly visible on the concrete for a period of at least four (4) hours after application.

2.4 Sealing Solution

.1 The sealing solution shall be a mixture of 50% boiled linseed oil and 50% kerosene or varsol.

3. EQUIPMENT

3.1 General

.1 All equipment necessary for the proper handling of materials, batching, mixing, placing, finishing and curing of concrete pavement shall be on the project in good working condition. Throughout the construction of the project, the Contractor shall maintain sufficient, adequate equipment in good, clean, working condition, to assure the proper execution of the work.

3.2 Mixing Equipment

.1 Concrete may be mixed at the site of construction, at a central point, or wholly or in part in truck mixers. Each mixer shall be an approved type and shall have attached, prominently, a manufacturer's plate showing the capacity of the drum in terms of volume of mixed concrete and the speed of rotation of the mixing drum or blades.

3.3 Sub-grade Trimmers

.1 Trimmers shall be self powered, capable of producing a clean smooth surface true to line and grade as indicated on the Drawings. Remaining loose material on sub-

grade shall not exceed 6 mm.

3.4 Slip Form Paving Machines (Extruders)

.1 Slip form paving machines, used for concrete placement, shall be of a size and type adequate to handle the width and thickness of the concrete section to be constructed. The slip form paver shall distribute the fresh concrete evenly to the required grade without segregation and without disturbing in-place reinforcing steel. The concrete shall be thoroughly consolidated by means of vibrators, struck off to exact grade and given a float finish, all automatically and continuously by the machine and with a minimum of hand finishing. The machine shall be equipped with automatic controls capable of controlling both the elevation and direction of the machine within a tolerance of 5 mm from the specified grade and alignment. Slip forms shall extend the full depth of the section and shall be of sufficient length that the concrete will not deform at the edges by the time the forms have passed.

3.5 Additional Equipment

.1 The Contractor shall furnish all other tools and supplies necessary for the proper execution of the Work.

4. EXECUTION

4.1 General

.1 Notify the Engineer 24 hours prior to commencement of operation.

4.2 Testing and Inspection

.1 The Owner may engage a CSA certified testing company to confirm the compliance to the specifications.

.2 The Contractor shall allow access and provide material for all tests by the Owners testing agency.

.3 The testing company is only authorized to report results of the tests and is not authorized to approve the construction. Any questions raised by the testing will be directed to the Owner.

.4 Testing Frequency shall be at 1 test per 50 cubic meters or 1 test per day on placed concrete whichever is greater.

.5 The cost of further testing will be at the expense of the Contractor if the concrete does not meet the specification criteria in the initial tests.

.6 Remedial action shall be at no expense to the Owner or the Engineer.

4.3 Base Construction

.1 Sidewalks and curb & gutter base material shall consist of cutting the existing sub-grade or filling with native material or if the contract specifies uniform backfill, specified granular materials will be installed to the designed grades as directed by the Engineer. The sidewalk base shall be compacted to a minimum of 100 % (standard Proctor maximum dry density) with a moisture content of plus / minus two percent (± 2%) of the specified optimum moisture content.

.2 When directed by the Engineer to stabilized soft areas, or as shown on the drawings granular base material shall be placed and compacted to the following requirements.

.1 Gradation to be within the following limits when tested to ASTM C-117 with sieve sizes to CAN/CGSB 8.2-M88, and to have a smooth curve without sharp breaks when plotted on a semi-log grading chart.

Sieve Size (microns)	Percent Passing By Weight
20 000	100
16 000	84 - 94
10 000	63 – 86
5 000	40 – 67
1 250	20 – 43
630	14 – 34
315	9 – 26
160	5 – 18
80	2 - 10

4.4 Dowelling

.1 Steel dowels to CSA G 30.18-M92, clean, plain, free from flattened or burred ends, free from rust, scale or other substances that prevent the bonding of the concrete to the reinforcement, uncoated.

.2 10 mm steel dowels shall be installed at a minimum of 1 dowel per 0.45m when tying into existing concrete structures.

4.5 Reinforcement

.1 Reinforcing bars, tie bars to CSA G30.18-M92 Grade 300, billet-steel, deformed bars, uncoated.

.2 Place reinforcing bars in lane crossings or as detailed.

.3 Clean reinforcing bars free of loose rust and mill scale.

4.6 Delivery

.1 When a truck mixer or agitator is used for transporting concrete, the concrete shall be delivered to the site of the work and discharge shall be completed within one and one-half (1½) hours after the introduction of the mixing water to the cement and aggregates (otherwise known as batch time). If the concrete has not been discharged by within one and on-half (1½) hours from batch time, the concrete shall be retested for slump, air and compressive strength. The concrete shall be rejected if any of the mix properties do not conform to the specified requirements.

.2 No water or chemical admixtures shall be added to the concrete mixture after one (1) hour from batch time.

.3 At no time will the concrete be accepted if the discharge has not been completed

within two (2) hours from the batch time.

4.7 Placement and Consolidation

.1 All concrete sections to be constructed in accordance with attached detailed drawings.

.2 Placing shall be continuous between planned transverse joints without the use of intermediate bulkheads. If concrete pavement is interrupted for more than 30 minutes, transverse construction joints shall be made.

.3 The concrete shall be placed or subsequently distributed to an even depth. The machine shall spread, screed, compact and float finish the concrete in one pass.

.4 Reinforcing bars may be inserted through temporary side forms located behind the paver, or mechanically inserted into the plastic concrete by approved devices associated with the slip form paver. Bars shall be inserted in such a manner that no voids are created around the bar, and no distortion of the pavement surface shall occur.

.5 The concrete shall be consolidated by internal vibrators of sufficient number, spacing and frequency to provide uniform consolidation to the entire section width and depth. The vibrators shall conform to the requirements of Clause 19.4.2 of CAN/CSA A23.1-04. The vibrators shall not operate while the paver is stopped.

.6 The concrete surface shall be protected from rain until the final set occurs.

4.8 Cold Weather Requirements

.1 Do not place concrete when air temperature is below 5 degrees Celsius, unless the following requirements are met:

.1 Preheat water and aggregates as well as reinforcement, forms and the ground.

.2 Concrete when deposited, shall have a temperature of not less than 4 degrees Celsius or more than 27 degrees Celsius under warm weather conditions. Concrete shall be covered and maintained at a temperature of at least 10 degrees Celsius for not less than seventy two (72) hours after placing, or until the concrete has cured.

.3 Do not use calcium chloride, except with the written permission of the Engineer and then only with normal Portland cement and in quantities less than 2% by weight. Close control of calcium chloride quantities and careful mixing is required.

4.9 Concrete Finishing

.1 After placing, concrete shall be finished as per the relevant sections of Clause 22 of CAN/CSA A23.1-04. Excess finishing is to be avoided. No plaster coat will be allowed. Adding water to the surface of the concrete to assist with finishing will not be allowed.

.2 Prior to final finishing, the surface grade of concrete slabs shall be checked to an

accuracy of plus or minus five (5) mm with a three (3) metre long metal straight edge. The straight edge shall be drawn across the surface in a scraping motion to identify deviations for immediate correction. The straight edge shall be advanced one-half its length for successive checks.

.3 Provide 15 mm deep by 5 mm wide contraction joints every 1.5 m on centre by means of marking tool or other approved method.

.4 Finish the outside edges of sidewalks and each edge of joints with 50 mm wide edging tool having a 6 mm radius.

.5 A broom finish shall be obtained by the use of a stiff, coarse fibre broom. A tined finish shall be obtained by the use of a device having irregularity spaced wire tines with an average spacing of 12 to 18 mm. The device shall be dragged transversely across the surface to form ridges. Transverse texturing shall be delayed until the concrete is sufficiently hard to retain the ridges.

.7 Apply curing compound to finished surface immediately after floating in accordance with manufacturer's printed instructions.

.8 The Contractor shall always have available material to protect the surface of the plastic concrete from damage from the rain. The materials shall consist of burlap, cotton mats, waterproof paper or plastic sheeting. Protection shall be employed when rain, sufficient to mar the texture of the concrete surface is expected. The decision of the Engineer in this regard shall be final.

.9 The Contractor is responsible to ensure the surface of the concrete is not vandalized during set-up. Any damaged surface must be repaired, or replaced, to the satisfaction of the Engineer.

4.10 Concrete Curing

.1 As soon as practical, after the texturing operation is complete, the entire pavement surface, including exposed sides, shall be cured by protecting it against loss of moisture, rapid temperature change and mechanical injury, in accordance with the requirements of Clause 21 of CSA A23.1-04 for Class C-2 concrete.

.2 The Contractor shall be responsible for taking all necessary measures to protect freshly placed concrete from adverse weather conditions, including hot weather, wind, rain, sleet, snow and cold weather, to the satisfaction of the Engineer. Concrete shall be adequately protected in accordance with the requirements specified in CAN/CSA-A23.1 – 04, Section 21.2.

.3 When Polyethylene film sheets (light coloured) or waterproof paper sheets are used, the sheets shall be long enough to cover the entire width and edges of the section and shall be lapped a minimum of 300 mm at joints. The sheets shall be adequately weighed to prevent displacement or billowing due to wind.

.4 When white liquid membrane forming curing compounds are employed, the compound shall be applied to exposed surface and edge of the concrete section following the final texturing operation, after all free bleed water has evaporated or been removed from the surface. Complete and uniform coverage, at a rate of three (3) to four (4) m^2/L shall be required. The compound shall be agitated to prevent pigment from settling.

.5 If the curing compound method of curing is used in combination with sawn control joints, provisions shall be made to cure and protect the exposed faces of the cleaned joint.

.6 When concrete has been placed in cold weather and the air temperature is expected to drop below 5 C, then polyethylene sheets, insulated curing blankets or other suitable material shall be placed beside the concrete members. Whenever the temperature is expected to reach the freezing point, during the day or night, the protective material shall be spread over the concrete surface and weighted to prevent movement to protect the concrete from freezing. Curing shall continue until the cumulative number of days, not necessarily consecutive, or fraction thereof, during which the temperature of the air in contact with the concrete is above 10 C, has totalled a minimum of seven (7) days. Alternatively, if compressive test of cylinders cured under field conditions achieve at least 70 percent (70%) of the specified compressive strength, curing may be discontinued.

.7 concrete placed in cool weather shall experience a minimum 30 day air drying period, following final curing, before the first application of de-icing salts.

.8 Concrete damaged as a result of inadequate protection against weather conditions shall be removed and replaced by the Contractor at his own expense.

4.11 Tolerances

.1 Meet the following criteria for exposed concrete surfaces:

.1 Trueness of surface: 6 mm maximum deviation in 3 m length.

.2 Elevation: 10 mm maximum deviation from given elevation.

.3 Alignment: 25 mm maximum deviation from given alignment.

.4 Crossfall: 2.0% +/- 0.2%

4.12 Backfill

.1 Backfilling shall be completed by the Contractor on all the concrete poured.

.2 Backfilling shall commence within 10 days, but no sooner than 7 days from the day the concrete was finished, or as directed by the engineer.

3 Material placed behind sidewalks or curb and gutter shall be compacted to a minimum 90% of Standard Proctor Density. Material shall be placed to the full height of concrete unless otherwise specified by the Engineer.

.4 Where landscaping is required, leave backfill 100 mm below finished grade to allow for topsoil and Sod.

4.13 Opening to Traffic

.1 In no case shall traffic or construction equipment be allowed on the concrete until the concrete has reached a minimum in situ compressive strength of 20 MPa, or has been allowed to cure for a minimum of seven (7) days.

5. FINAL INSPECTIONS

5.1 Inspection

.1 All workmanship and all materials furnished and supplied under this Specification are subject to close and systematic inspection and testing by the Engineer including all operations from the selection and production of materials through final acceptance of the specified work. The Contractor shall be wholly responsible for the control of all operations incidental thereto notwithstanding any inspection or approval that may have been previously given. The Engineer reserves the right to reject any materials or works which are not in accordance with the requirements of this Specification.

5.2 Access

.1 The Engineer or a designate shall be afforded full access for the inspection and control testing of concrete and constituent materials, both at the site of work and at any plant used for the production of concrete, to determine whether the concrete is being supplied in accordance with this Specification.

5.3 Thickness

.1 At the opinion of the Engineer, the thickness of concrete members may be determined by coring sections representing each day's pour and determining the depth of each core by average measurements of the core.

.2 Members found deficient in thickness by more than 5 percent shall be paid for at the reduced price as follows:

Deficiency in Concrete Thickness (mm)	Payment, Percentage Contract Unit Price
5	100
15	75
20	50
25 or Greater	Removal and Replace

.3 The cost of the initial quality assurance core testing shall be paid for by the Engineer. Additional cores requested by the Contractor to determine the extent of areas deficient in thickness shall be paid for by the Contractor.

5.4 Compressive Strength

.1 Payment adjustments for compressive strength are as follows:

Average Compressive Strength	Payment Adjustment Factor
Compliant or greater	1.00
24.0 MPa to 24.9 MPa	0.95
23.0 MPa to 23.9 MPa	0.90
Below 23.0 MPa	Reject (Note 1)

Note 1: Subject to removal and replacement at the discretion of the Engineer.

5.5 Air Content

.1 Payment adjustments for air content are as follows:

Average Air Content	Payment Adjustment Factor
5% or greater	1.00
4.59% - 4.9%	0.90
4.09% – 4.4%	0.80
Below 4.0%	Reject (Note 1)

Note 1: Subject to removal and replacement at the discretion of the Engineer.

5.6 Final Acceptance

.1 In the event where the compressive strength of the test cylinders, low air entrainment, deficient slump, improper compaction of the concrete base, poor finishing or crossfall, trueness of surfaces, elevation and alignment tolerances for any portion of the work does not meet the requirements specified herein, the City of Medicine Hat and its representatives, at their discretion may require that the portion (s) deemed deficient be completely removed and replaced at the expense of the Contractor.

END OF SECTION

BACKFILL REGULATIONS FOR PUBLIC RIGHT- OF- WAYS

1. GENERAL

1.1 Description

.1 The following specifications apply to compaction of all water, sewer (storm and domestic) service cuts, repairs, replacements, mainbreaks, extensions, etc. and all shallow utility cuts by utility companies on all existing or proposed streets, lanes or easements for full width of the right-of-way where the City of Medicine Hat is responsible for maintenance.

.2 A trench cut is defined as that portion of any excavation extending from within 300 mm below the pipe to the finished subgrade surface.

.3 With regard to the area from the bottom of the bedding to 300 mm above the pipe, method of backfill and compaction and type of equipment used in water and sewer installations must comply with the Standard Specification, Environmental Utilities Department.

.4 An excavation permit must be obtained prior to excavation in the City of Medicine Hat for the installation of utilities or any other purpose regardless of whether the area is paved, graveled, or unimproved. These excavation permits are to be obtained from the Municipal Works Department at 188 Kipling Street SE. The applicant will receive two copies of each excavation permit and as soon as the work involved is completed, one form is to be returned immediately so that the Municipal Works Department can carry out any additional rehabilitation work that may be required.

.5 Utility excavations shall not be permitted on roads that are either newly constructed or resurfaced with the past two (2) years. Exceptions shall be granted only where it can be proved that the excavation was beyond the control of the utility involved. Proposed excavations within the two (2) year period other than emergencies or redevelopment/development servicing shall be reviewed by the General Manager of the City Municipal Works Department.

2. PRODUCTS

2.1 Backfill Materials

.1 Native Backfill

.1 Selected material from excavation approved by the Engineer for the intended use, unfrozen and free from rocks larger than 75 mm, cinders, ashes, sods, refuse or other deleterious materials.

.2 Non Shrink Backfill

.1 Low strength concrete (fillcrete):

.1 Compressive Strength of 0.2 MPa to 0.5 MPa.

.2 Maximum compressive strength shall not exceed 0.5 MPa in 56 days.

.2 Slump Requirements:

.1 Minimum Slump – 75 mm

.2 Maximum Slump – 125 mm

.3 Admixtures:

.1 Calcium Chloride may be used.

.2 Air entrainment 4 – 7 %.

.4 Aggregate Gradation:

SIEVE SIZE	PERCENT PASSING
10 mm	100
5 mm	95 – 100
2.5 mm	80 – 100
1.25 mm	50 – 100
630 um	25 – 65
315 um	10 – 35
160 um	2 – 5
80 um	0 - 10

.3 Granular Backfill

.1 Gradation to be within the following limits when tested to ASTM C-117 with sieve sizes to CAN/CGSBD 8-GP-2M rather than ASTM E11, and to have a smooth curve without sharp breaks when plotted on a semi-log grading chart.

Sieve Size (microns)	Percent Passing By Weight
20 000	100
16 000	84 - 94
10 000	63 – 86
5 000	40 – 67
1 250	20 – 43
630	14 – 34
315	9 – 26
160	5 – 18
80	2 - 10

3. EXECUTION

3.1 General

.1 Requirements apply to the full width of the right-of-way with the exception of the boundary area from the property line up to one (1) meter from the constructed or designed surface installation.

3.2 Site Preparation

.1 The Contractor at his own expense shall clear and broom clean the surface of the pavement as may be necessary for full width and length of the work area and shall dispose of all refuse in a manner satisfactory to the Engineer.

3.3 Concrete and Asphalt Removal and Disposal

.1 Trenching across existing paved streets or lanes will be allowed only when it has been deemed by the Engineer that coring/auguring is impossible or impractical.

.2 Perform all concrete and asphalt removal and disposal according to Section 05200 Concrete and Asphalt Removal and Disposal.

3.4 Backfill and Compacting

.1 Do not proceed with backfilling operations until Engineer has inspected and approved installations.

.2 Prior to backfilling, the excavation shall be completely free of debris, ponding water or drifted snow.

.3 Place backfill material in uniform layers not exceeding 300 mm uncompacted thickness up to grades indicated. Compact each layer before placing succeeding layer.

.4 Fill materials shall be moisture conditioned, by drying or by adding water, to obtain an in-place moisture content ± 2% of the optimum moisture content.

.5 Compact each lift throughout its entirety to the following:

.1 Pipe or Cable Zone - 300 mm below to 300 mm above the pipe or Cable Zone to a minimum of 95% of standard Proctor maximum dry density.

.2 Above Pipe or Cable Zone to the finished elevation – to a minimum of 98% of standard Proctor maximum dry density.

.6 When soils removed from any trench appear unsuitable for replacement in the trench due to excessive moisture content, or for any other reason and suitable material is not available on site, the trench shall be backfilled with granular material or non-shrinkable backfill with prior written approval by the Engineer. Under no circumstances shall frozen material be used for backfill.

.7 In landscaped areas place native backfill to 300 mm below the finished grade to allow for topsoil placement.

.8 On existing paved streets and lanes, or existing graveled streets and lanes native backfill shall be brought up to the existing subgrade only. The final 150 mm depth

of the sub-grade shall be compacted and moisture conditioned in accordance with Section 05010 Sub-grade Preparation.

.9 On existing paved streets and lanes, or existing graveled streets and lanes the base structures shall be rebuilt with specified granular sub-base and base materials shall be in accordance with Section 05020 Granular Base/Sub-base Preparation. Compaction of the base granular bas structures shall be in accordance with Section 05020 Granular Base/Sub-base Preparation.

.10 On existing paved streets and paved lanes, asphalt shall be replaced in accordance with Section 05140 Asphalt Concrete.

3.5 Winter Compaction

.1 During these portions of the year, when specified densities cannot be obtained due to cold weather, a minimum of ninety five (95%) of standard Proctor maximum dry density above the pipe zone will be acceptable.

.2 If a minimum of ninety five (95%) of standard Proctor maximum dry density above the pipe zone is unobtainable, non shrink backfill is an approved alternate and recommended during winter backfill operations versus the use of native and granular materials.

.3 Cold mix asphalt shall be used for the final surfacing of roadways during the winter months. The cold mix shall be removed and replaced with the specified hot mix asphalt in early spring. All settlements related to winter backfill operations must be repaired by the Contractor prior to placing hot mix asphalt.

3.6 Non Shrink Backfill Placement

.1 Non shrink backfill delivered in cold weather shall conform to the requirements specified in Section 18 of CAN/CSA 23.1-04.

.2 Non shrink backfill shall be rodded or vibrated to eliminate voids, rough areas, honeycombing and to ensure contact with the sides of the excavation.

.3 Place materials using methods which do not lead to segregation.

.4 Pumping of material is permitted with the approval of the Engineer.

.5 In landscaped areas place non shrink backfill to 300 mm below the finished subgrade to allow for topsoil placement.

.6 Temporary plating or other means of supporting traffic loads shall be used to provide safe driving surface for traffic until pavement materials are replaced.

.7 Protect freshly placed material from heavy rain to prevent washout.

.8 Protect freshly placed non shrink backfill from freezing.

.9 Allow material to cure for a period of 48 hours to ensure adequate strength.

3.7 Testing

.1 The Engineer shall appoint an independent testing consultant to perform all compaction tests for acceptance in accordance with the requirements of this

section. Density tests shall be representative of the entire length, width and depth of the trench backfill including around catch basins, manholes, valves and service connections. Test data provided by this testing agency shall be final and binding on both the Owner and the Contractor.

.2 The following is the minimum testing frequency:

.1 Trenches more than 15 meters in length shall require a minimum of three (3) density tests per 500 mm of trench depth per 75 meters of trench length.

.2 Trenches less than 15 meters in length shall require a minimum of two (2) density tests evenly distributed throughout the length of the trench, per 500 mm of trench depth.

.3 Maintenance excavations less than 6 square meters in area shall require one (1) density test per 500 mm of depth.

.4 Backfill adjacent to valves, manholes, catch basins and other structures shall require a minimum of two (2) density tests for every 500 mm of trench depth.

.5 All sewer and watermain installations within the City right-of-way are subject to continuous testing and inspection to verify compliance with current backfill and compaction specifications.

.6 Inspection and testing of non shrink fill will be carried out by a CSA certified testing agency designated by the Engineer. Tests for compressive strength, slump and air entrainment shall be performed for each 50 m^3 of non shrink fill placed.

.7 The Engineer may determine additional testing as necessary.

4. BACKFILL COMPLIANCE

4.1 General

.1 A minimum of three (3) copies of all test results shall be submitted to the City of Medicine Hat Municipal Engineering Department complete with an Engineers sealed “Letter of Certification” signifying that all City of Medicine Hat backfill specifications have been met or exceeded.

.2 In the event that the entire street serviced area is deficient or irregular in testing coverage or fails to maintain the design cross-section and/or grade at any period prior to the issuing of the Final Acceptance Certificate (FAC), that portion of the construction may be retested under observation by the Engineer or his representative prior to the issuing of the FAC for the paving and concrete surface work. If such action is not undertaken, or the re-tests do no indicated compliance, the value of the surfaces improvements constructed in the affected area may be computed and a deposit in this amount may be required to serve as a guarantee against the failure of the surface improvement due to failures in the sub-grade or granular base structures. The term of such a deposit is five (5) years and the deposit is required prior to construction of surface improvements.

5. MAINTENANCE

5.1 General

.1 The Contractor will be responsible for the rehabilitation costs of failures due to settlement of the backfill within one year of completion date. If any obvious major settlement occurs, the Engineer may require the trench to be re-compacted for its full depth and length.

END OF SECTION

PROJECT CLOSE OUT – CCC/FAC PROCEDURES

1. DESCRIPTION

This document identifies the application submission requirements for the application to the City of Medicine Hat, Municipal Works Department for Construction Completion Certificates (CCC) and Final Acceptance Certificates (FAC) pertaining to Storm Sewers, Roadworks and other associated installations.

2. Construction Completion Certificate Application

Prior to application for the CCC, the Contractor will carefully inspect the work and ensure all contractual obligations have been completed. All major and minor construction deficiencies are corrected and the total Project area is clean and in a condition suitable for inspection and occupancy.

The Contractor will notify the Engineer, in writing, of substantial completion of the work and request an inspection.

The inspection team shall consist of at a minimum, representatives for the Contractor, the Engineer and the City of Medicine Hat. The time and date of the inspection shall be agreeable to all parties such that the inspection be performed with all concerned parties present.

3. Construction Completion Certificate Inspection

The Construction Completion Certificate Inspection procedure shall consist of but not be limited to the following:

.1 Confirmation that all video inspections for underground installations have been completed, submitted, reviewed and accepted.

.2 Confirmation that all As Built Project Plans have been completed, stamped by a Professional Engineer, submitted, reviewed and accepted.

.3 Confirmation that all Quality Assurance Testing Reports have been completed, submitted, reviewed and accepted.

.4 All Manholes and Catch-basins will be visually inspected ensuring the structures are free of debris, damage or deficiencies.

.5 All Concrete Structures , i.e. sidewalks, curbs, gutters, swales, intakes, outfalls or any contract specific items are free of debris, damage or deficiencies.

.6 All work within the Road Right of Way, i.e. roadway structure, signage, street lighting, silt protection or any contract specific items are completed and are in accordance with the contract documents.

.7 All Line and Grade requirements are completed and are in accordance with the contract documents.

PROJECT CLOSE OUT – CCC/FAC PROCEDURES

4. Construction Completion Certificate Deficiencies

.1 All deficiencies identified during the inspection shall be compiled by the Engineer and recognized as the CCC Deficiency List.

.2 When applicable, the value of the deficiencies will be assessed by the Engineer. The total amount of this assessment will be withheld at the time of Release of Holdback pending Total Completion of the Work.

.3 Such deficiencies shall be corrected by a date mutually agreed upon between the Contractor, the Engineer, and the City. A re-inspection by the concerned parties shall be requested by the Contractor, following his own inspection.

.4 The contractor is cautioned to avoid unnecessary inspections. The cost of subsequent inspections after the first re-inspection will be borne by the contractor.

5. Final Acceptance Certificate Application

.1 The application for the FAC shall be made once the specified warranty period has expired or the construction disciplines have been completed to the scope of work identified in the Owner's Service Agreement.

.2 Prior to application for the FAC, the Engineer will carefully inspect the work and ensure that all construction or any project related items are in accordance with the project specifications. The inspection team shall consist of at a minimum the Engineer and the City. The time and date of the inspection shall be agreeable to all parties.

6. Final Acceptance Certificate Inspection

The Final Completion Certificate Inspection shall consist of the following:

.1 All Manholes and Catch-basins will be visually inspected ensuring the structures are free of debris, damage or deficiencies.

.2 All Concrete Structures , i.e. sidewalks, curbs, gutters, swales, intakes, outfalls or any contract specific items are free of debris, damage or deficiencies.

.3 All Laneway Grading and Surface Treatment requirements are completed and are in accordance with the contract documents.

.4 All work within the Road Right of Way, i.e. roadway structure, signage, street lighting, silt protection (remove/replace) or any contract specific items are completed and are in accordance with the contract documents.

7. Final Acceptance Certificate Deficiencies

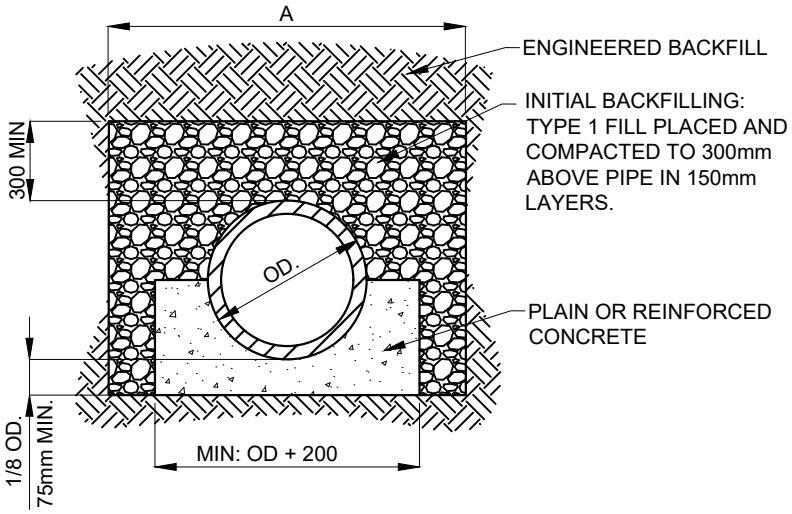
.1 All deficiencies noted by the Engineer and the City shall be compiled by the Engineer and will be recognized as the Final Acceptance Deficiency List.

.2 Such deficiencies shall be corrected by a date mutually agreed upon between the Engineer and the City.

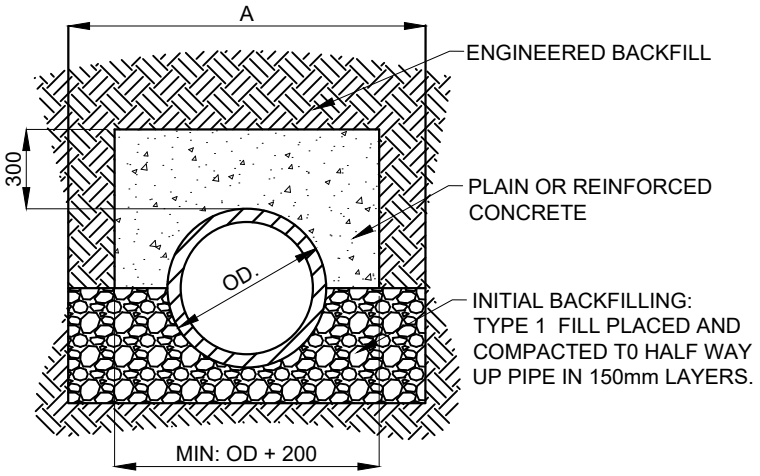
END OF SECTION

MW Construction Specification
Standard Detail Drawings

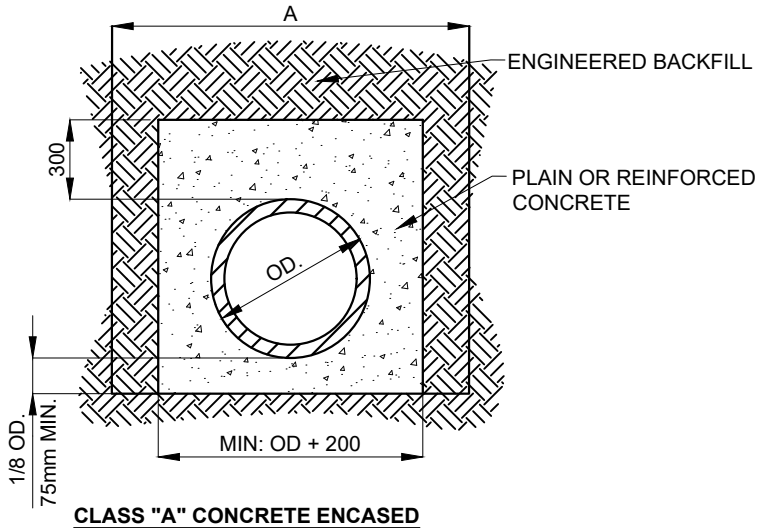
Part 1 – Storm Drainage



CLASS "A" CONCRETE CRADLE - RIGID PIPE



CLASS "A" CONCRETE ARCH



CLASS "A" CONCRETE ENCASED

NOTES:

1. Lf = 2.2 TO 3.4
2. CONCRETE FOR CLASS "A" BEDDING SHALL BE IN ACCORDANCE WITH SECTION 03300 CAST-IN-PLACE CONCRETE.
3. BACKFILL MATERIALS SHALL BE IN ACCORDANCE WITH SECTION 03000 EXCAVATION, TRENCHING AND BACKFILLING.
4. BACKFILLING REQUIREMENTS AS PER SECTION 03000 EXVACATION, TRENCHING, AND BACKFILLING AND SECTION 06000 BACKFILL REGULATIONS FOR PUBLIC RIGHT-OF-WAYS.
5. ALL UNITS SHOWN IN mm UNLESS OTHERWISE NOTED.
6.

DEPTH OF MATERIAL BELOW PIPE	
PIPE DIAMETER (mm)	BEDDING DEPTH (mm)
675 OR SMALLER	75
750 TO 1500	100
1650 OR LARGER	150

LEGEND

OD - OUTSIDE DIAMETER

ID - INSIDE DIAMETER

A - TRENCH WIDTH - 900mm FOR 525 DIA. PIPE & SMALLER OR 1.33 X ID + 200mm FOR 600mm OR LARGER.

Lf - LOAD FACTOR

No.	YY	MM	DD	REVISION DESCRIPTION	BY
2	23	04	04	SPECIFICATION AUTHENTICATION	SP
1	15	01	20	TITLEBLOCK/FONT/DWG NUMBER	PMD
0	09	02	26	FOR APPROVAL	PNB

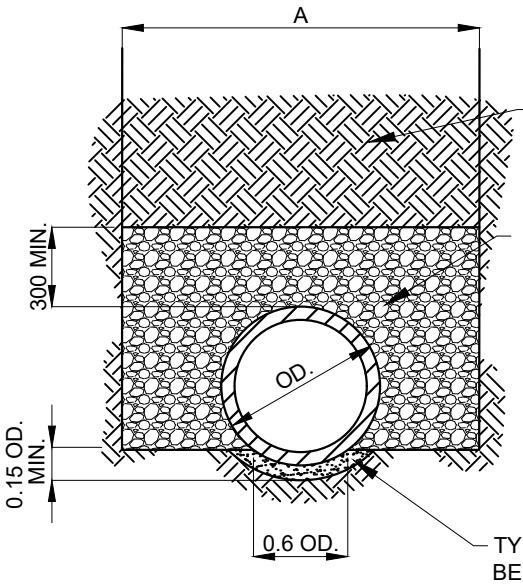
DATE

DATE: 02/20/09
SCALE: NTS
DRAWN: PNB
APPROVED:

Medicine Hat
The Gas City

CLASS "A" BEDDING

DWG. No. ST 400 Rev. 2

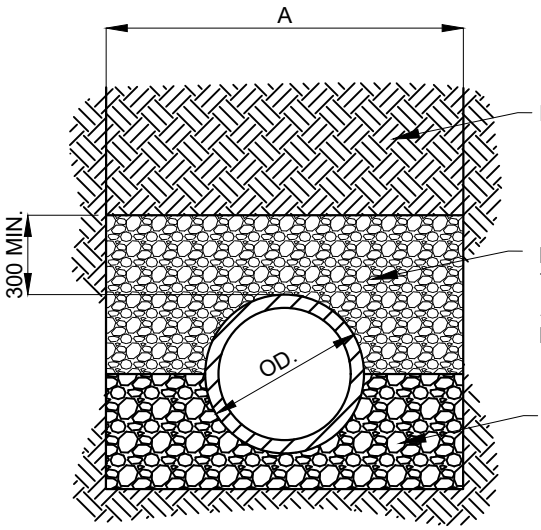


CLASS "B" SHAPED SUB-GRADE

NOTES:

1. Lf = 1.9
2. BACKFILL MATERIALS SHALL BE IN ACCORDANCE WITH SECTION 03000 EXCAVATION, TRENCHING AND BACKFILLING.
3. BACKFILLING REQUIREMENTS AS PER SECTION 03000 EXVACATION, TRENCHING, AND BACKFILLING AND SECTION 06000 BACKFILL REGULATIONS FOR PUBLIC RIGHT-OF-WAYS.
4. ALL UNITS SHOWN IN mm UNLESS OTHERWISE NOTED.
5.

DEPTH OF MATERIAL BELOW PIPE	
PIPE DIAMETER (mm)	BEDDING DEPTH (mm)
675 OR SMALLER	75
750 TO 1500	100
1650 OR LARGER	150



CLASS "B" GRANULAR BEDDING

LEGEND

OD - OUTSIDE DIAMETER

ID - INSIDE DIAMETER

A - TRENCH WIDTH - 900mm FOR 525 DIA. PIPE & SMALLER OR
1.33 X ID + 200mm FOR 600mm OR LARGER.

Lf - LOAD FACTOR

No.	YY	MM	DD	REVISION DESCRIPTION	BY
2	23	04	04	SPECIFICATION AUTHENTICATION	SP
1	15	01	20	TITLEBLOCK/FONT/DWG NUMBER	PMD
0	09	02	26	FOR APPROVAL	PNB

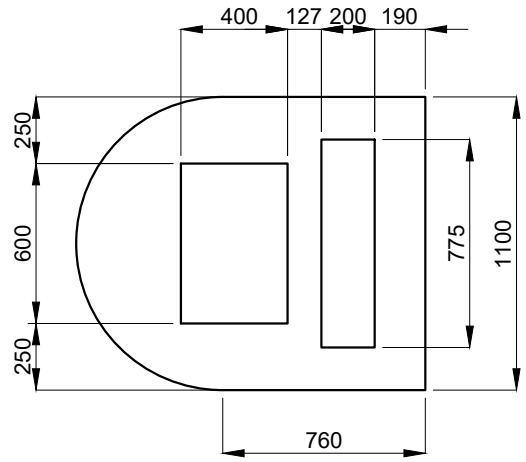
DATE

DATE: 02/23/09
SCALE: NTS
DRAWN: PNB
APPROVED:

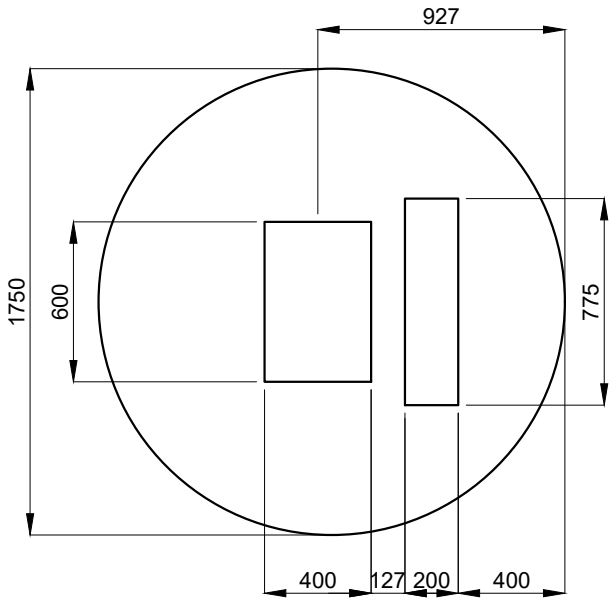
Medicine Hat
The Gas City

CLASS "B" BEDDING

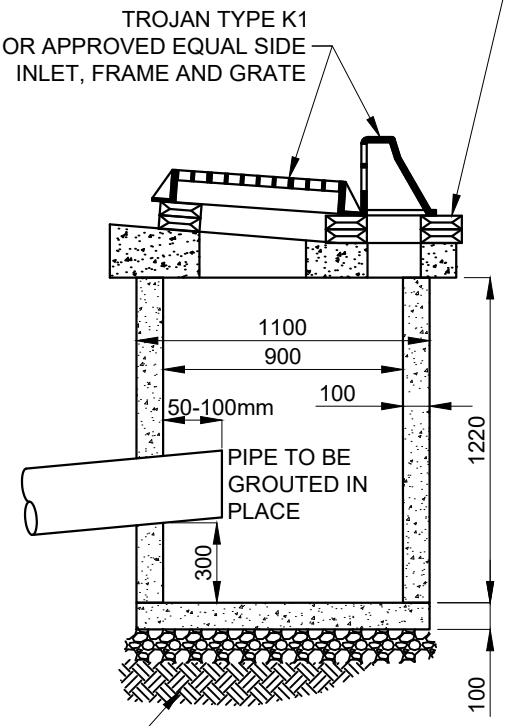
DWG. No. ST 401 Rev. 2



TYPE K-1 "T" TOP



CBMH K-1 TOP



K-1 CATCH BASIN

NOTES:

1. PRE-CAST CONCRETE PRODUCTS TO BE LAFARGE, PRECON, INLAND, OR APPROVED EQUAL.

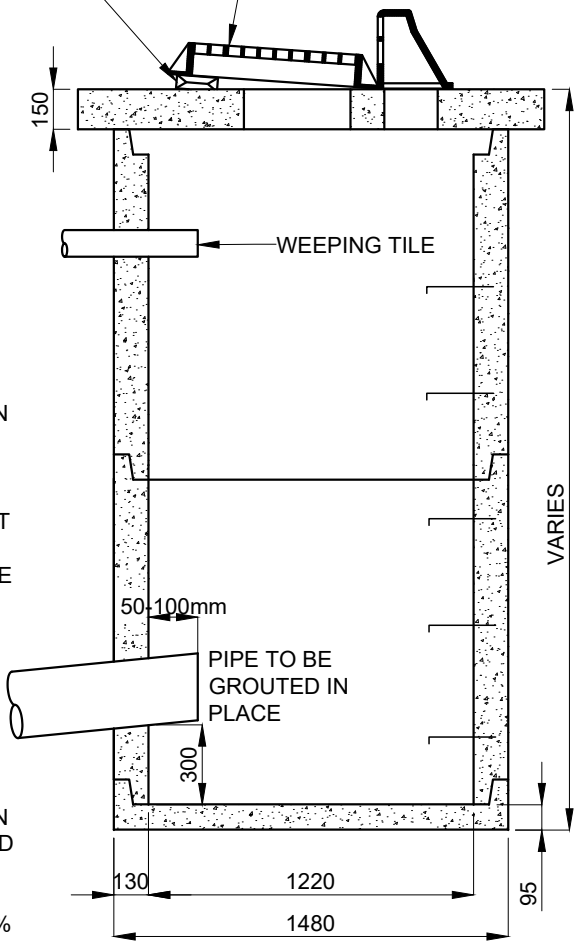
2. NON SHRINK GROUT FOR FINAL BRICK ADJUSTMENTS AND INSTALLATIONS OF LEADS SHALL BE IN ACCORDANCE WITH SECTION 03300 CAST-IN-PLACE CONCRETE.

3. CATCH BASIN LEADS MUST PROTRUDE BETWEEN 50mm AND 100mm FROM THE INSIDE WALL OF CATCH BASIN OR MANHOLE.

4. ALL UNITS IN mm UNLESS OTHERWISE NOTED.

5. FINAL CATCH BASIN ADJUSTMENTS SHALL BE IN ACCORDANCE WITH SECTION 03150 STORM MANHOLES AND CATCH BASINS.

6. 250mm MIN. PIPE SIZE & 1% MIN. SLOPE FOR CONNECTION TO MAIN



K-1 CATCH BASIN MANHOLE

No.	YY	MM	DD	REVISION DESCRIPTION	BY
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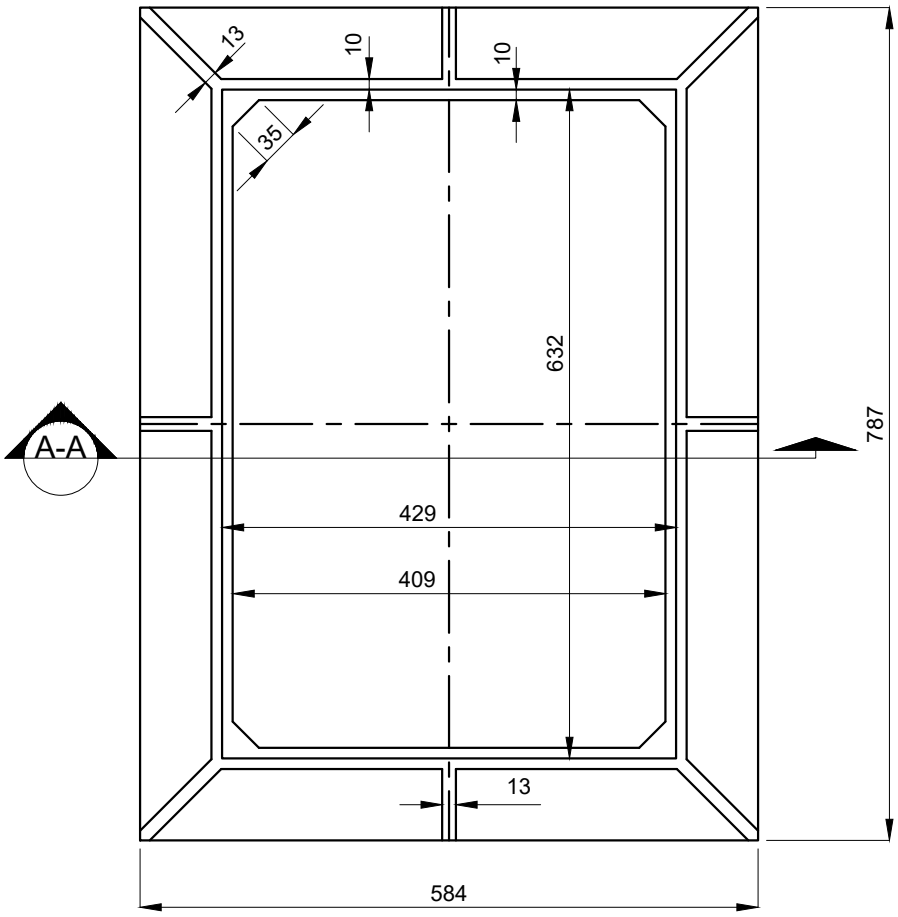
0	09	02	26	FOR APPROVAL	PNB

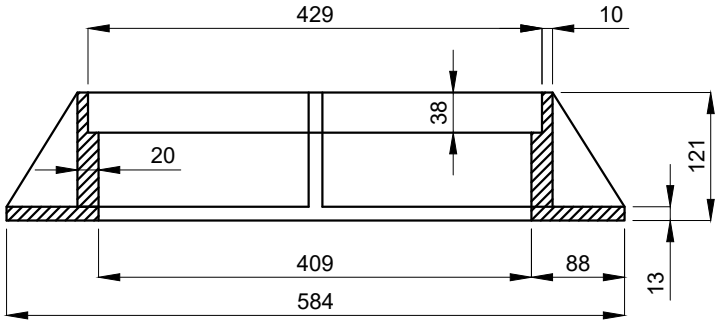
DATE: 02/11/09
SCALE: NTS
DRAWN: PNB
APPROVED:

Medicine Hat
The Gas City

TYPE K-1 CATCH BASIN & CATCH BASIN MANHOLE TOP SECTION

DWG. No. ST 402 Rev. 2





SECTION A-A

No.	YY	MM	DD	REVISION DESCRIPTION	BY
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1	15	01	20	TITLEBLOCK/FONT/DWG NUMBER	PMD
0	09	02	26	FOR APPROVAL	PNB

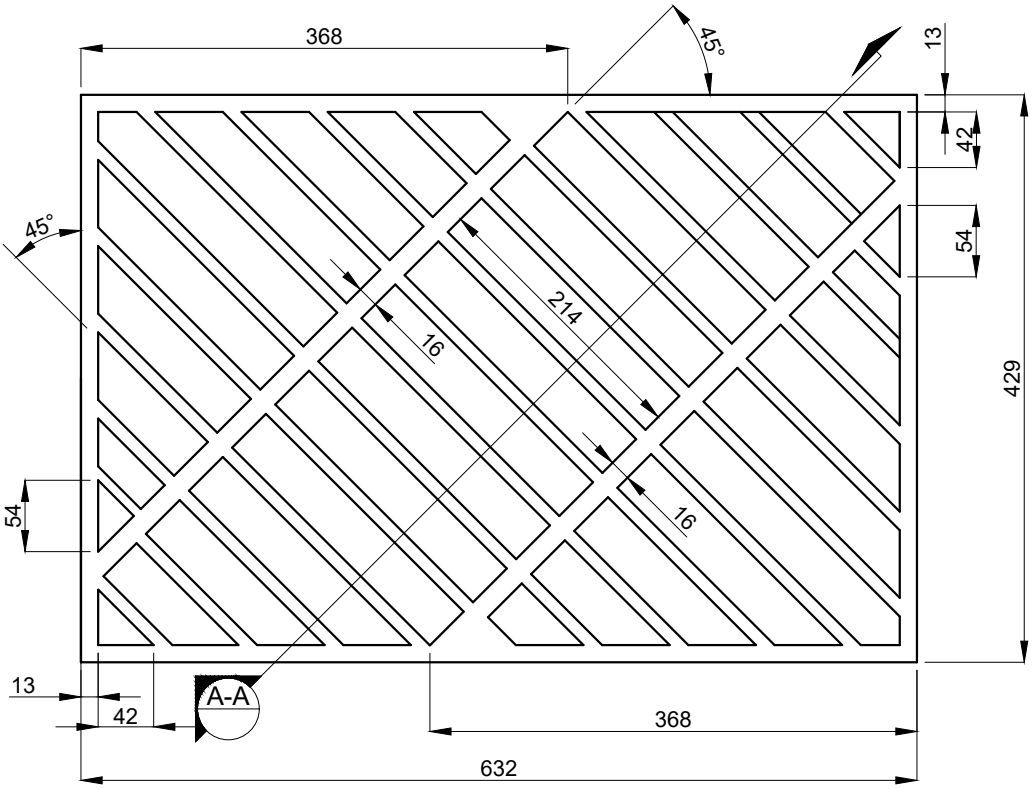
DATE

DATE: 02/11/09
SCALE: NTS
DRAWN: PNB
APPROVED:

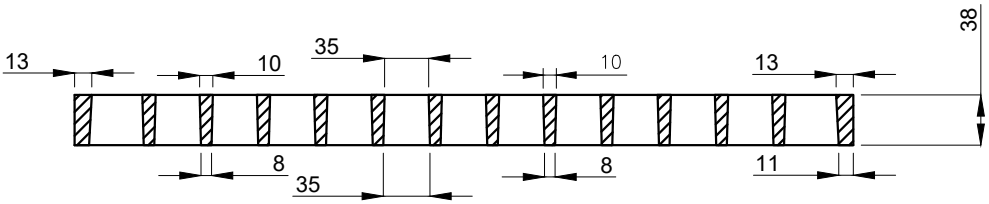
Medicine Hat
The Gas City

K1 CATCH BASIN
FRAME

DWG. No. ST 403 Rev. 2



PLAN



SECTION A-A

No.	YY	MM	DD	REVISION DESCRIPTION	BY
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1	15	01	20	TITLEBLOCK/FONT/DWG NUMBER	PMD
0	09	02	26	FOR APPROVAL	PNB

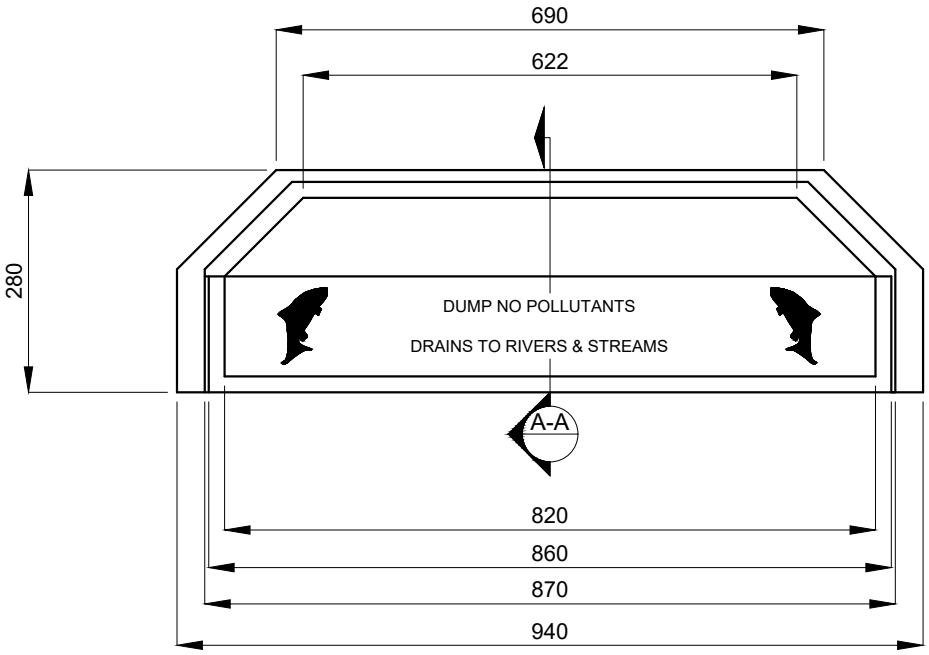
DATE

DATE: 02/11/09
SCALE: NTS
DRAWN: PNB
APPROVED:

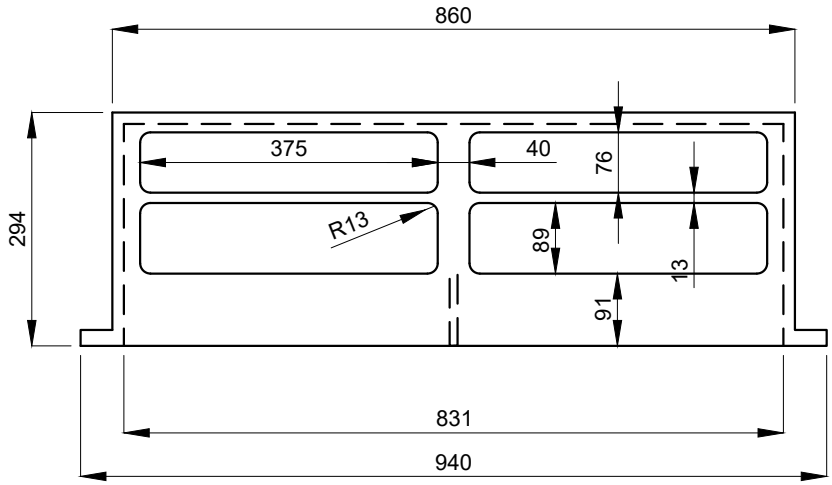
Medicine Hat
The Gas City

K1 CATCH BASIN
GRATE

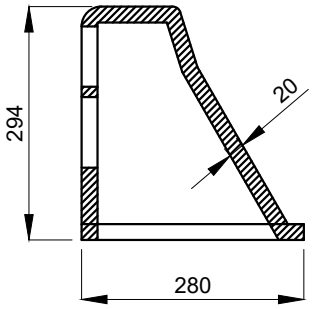
DWG. No. ST 404 Rev. 2



PLAN



FRONT VIEW



SECTION A-A

No.	YY	MM	DD	REVISION DESCRIPTION	BY
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0	09	02	26	FOR APPROVAL	PNB

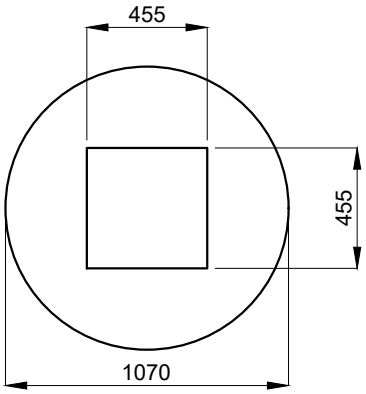
DATE

DATE: 02/11/09
SCALE: NTS
DRAWN: PNB
APPROVED:

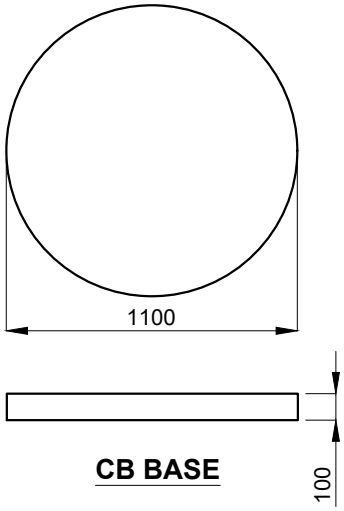
Medicine Hat
The Gas City

K1 CATCH BASIN
SIDE INLET

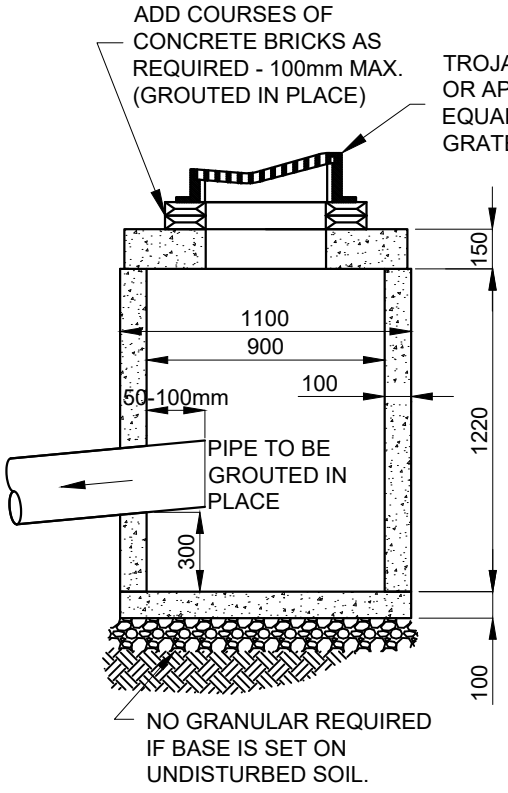
DWG. No. ST 405 Rev. 2



TYPE K-7 "E" TOP



CB BASE



NOTES:

1. PRE-CAST CONCRETE PRODUCTS TO BE LAFARGE, PRECON, INLAND, OR APPROVED EQUAL.

2. NON SHRINK GROUT FOR FINAL BRICK ADJUSTMENTS AND INSTALLATIONS OF LEADS SHALL BE IN ACCORDANCE WITH SECTION 03300 CAST-IN-PLACE CONCRETE.

3. CATCH BASIN LEADS MUST PROTRUDE BETWEEN 50mm AND 100mm FROM THE INSIDE WALL OF CATCH BASIN OR MANHOLE.

4. ALL UNITS IN mm UNLESS OTHERWISE NOTED.

5. FINAL CATCH BASIN ADJUSTMENTS SHALL BE IN ACCORDANCE WITH SECTION 03150 STORM MANHOLES AND CATCH BASINS.

6. 250mm MIN. PIPE SIZE & 1% MIN. SLOPE FOR CONNECTION TO MAIN

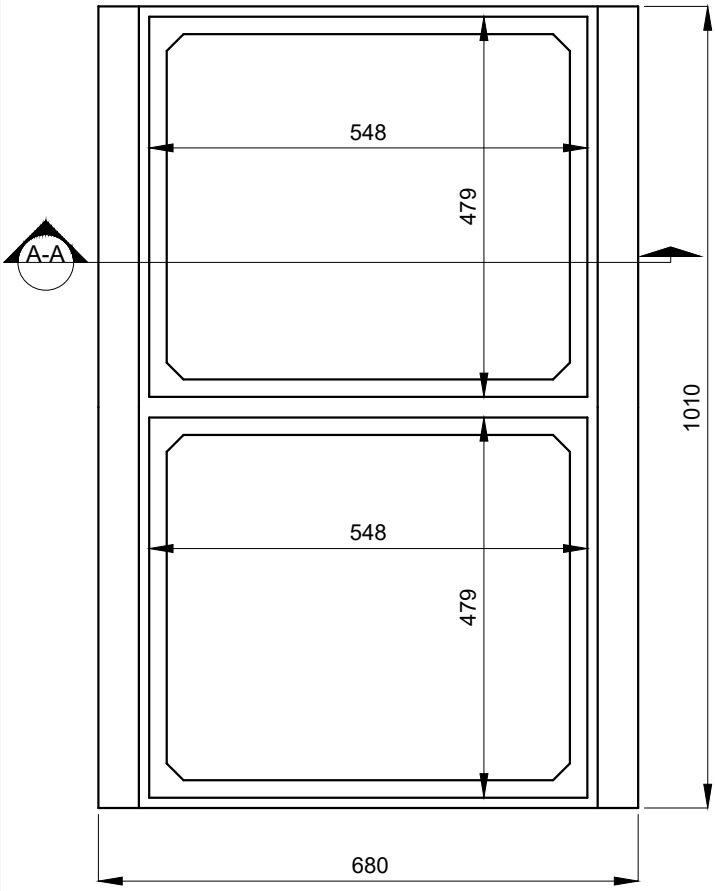
No.	DATE YY	MM	DD	REVISION DESCRIPTION	BY
2	23	04	04	SPECIFICATION AUTHENTICATION	SP
1	15	01	20	TITLEBLOCK/FONT/DWG NUMBER	PMD
0	09	02	26	FOR APPROVAL	PNB

DATE: 02/11/09
SCALE: NTS
DRAWN: PNB
APPROVED:

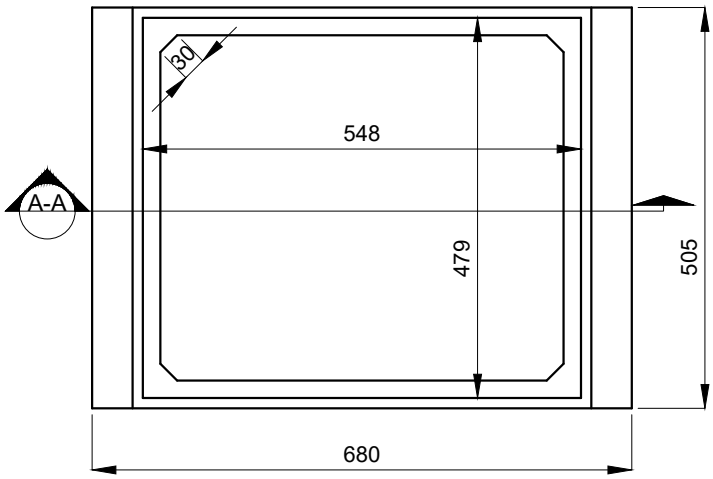
Medicine Hat
The Gas City

K7 CATCH BASIN

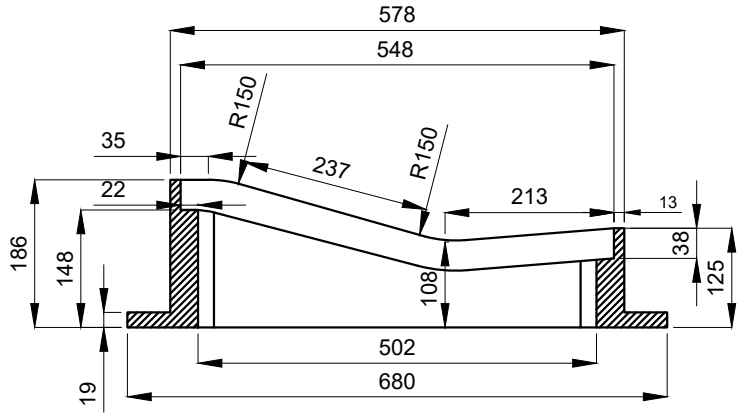
DWG. No. ST 406 Rev. 2



DOUBLE K-7 FRAME



SINGLE K-7 FRAME



SECTION A-A

No.	YY	MM	DD	REVISION DESCRIPTION	BY
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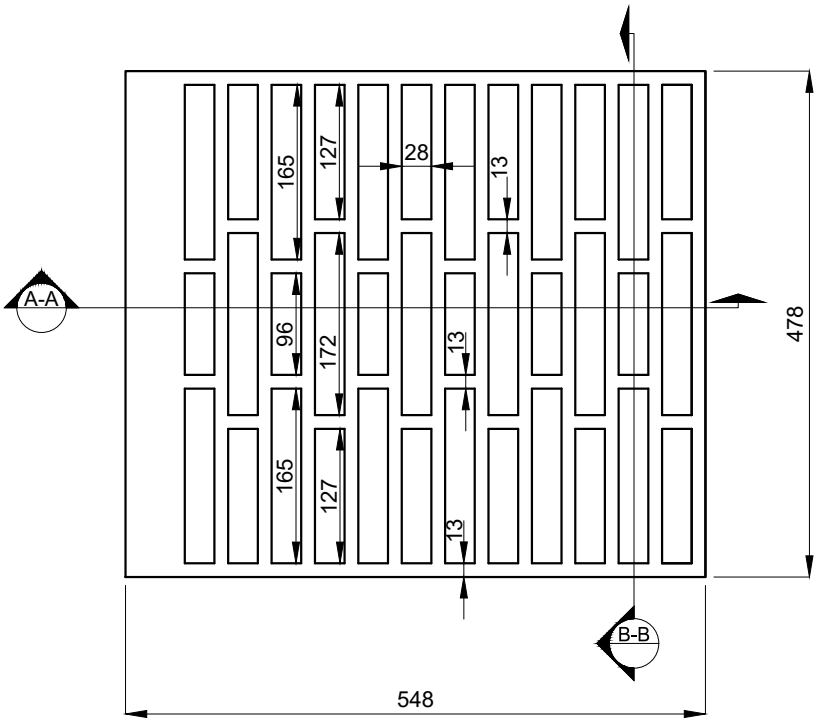
DATE

DATE: 02/11/09
SCALE: NTS
DRAWN: PNB
APPROVED:

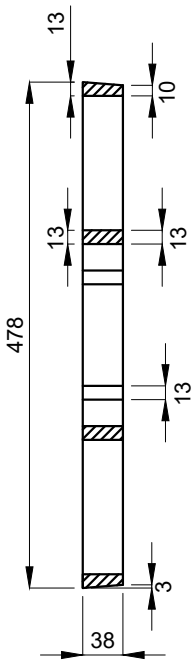
Medicine Hat
The Gas City

K-7 CATCH BASIN FRAME

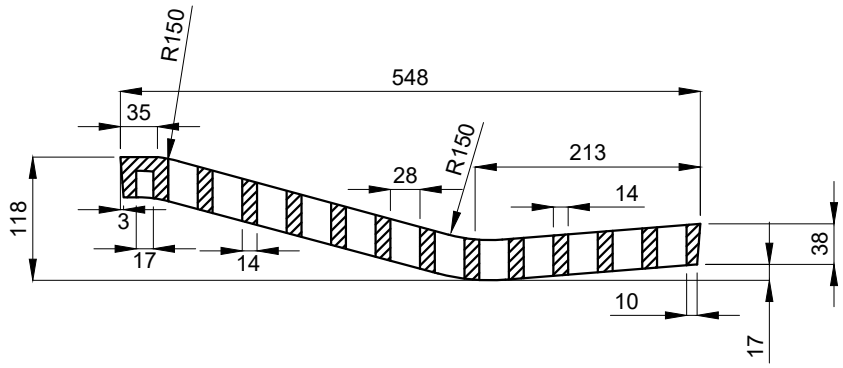
DWG. No. ST 407 Rev. 2



PLAN

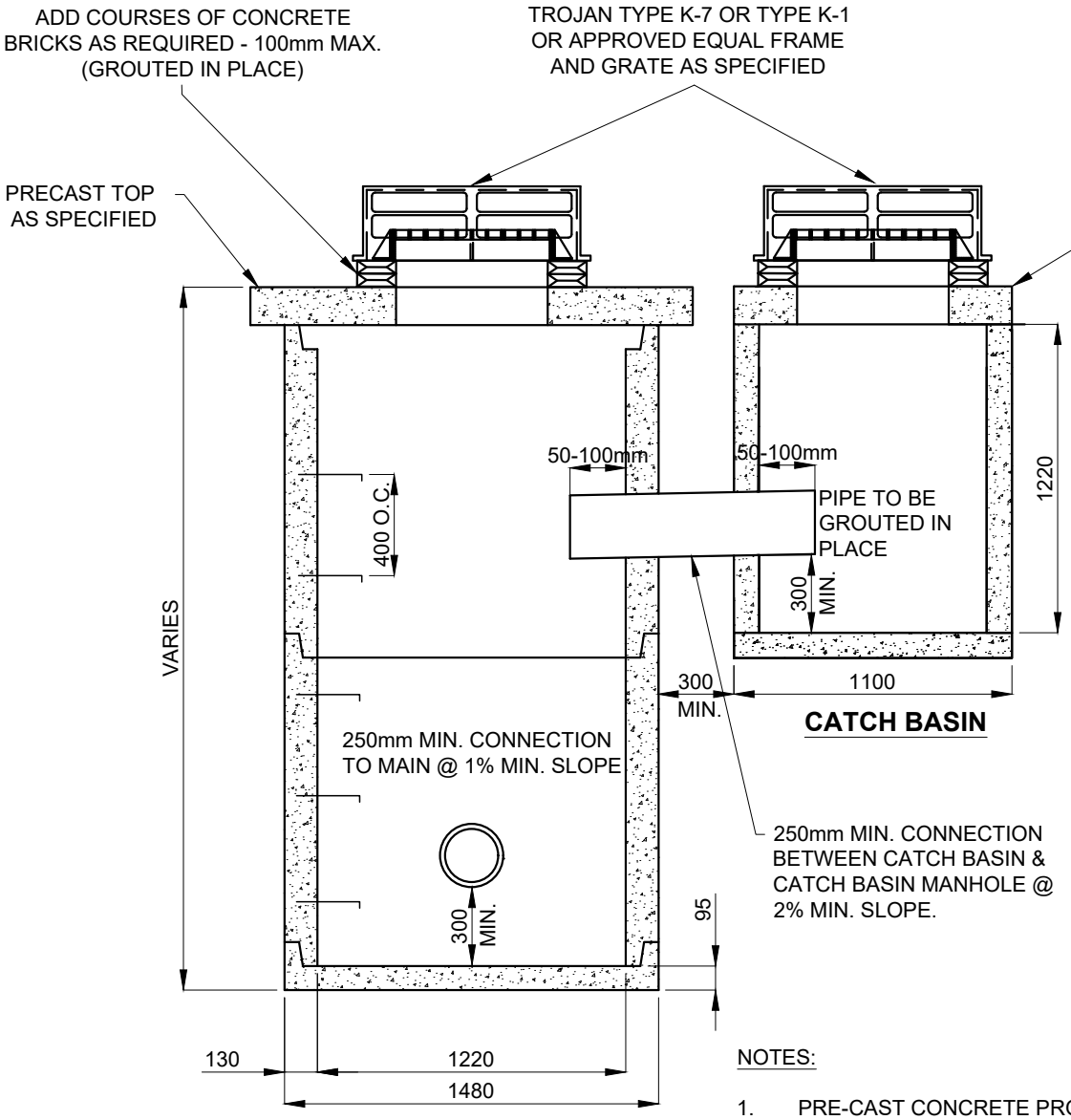


SECTION B-B



SECTION A-A

						DATE: 02/11/09	Medicine Hat The Gas City
						SCALE: NTS	K7 CATCH BASIN GRATE
2	23	04	04	SPECIFICATION AUTHENTICATION	SP	DRAWN: PNB	
1	15	01	20	TITLEBLOCK/FONT/DWG NUMBER	PMD	APPROVED:	DWG. No. ST 408 Rev. 2
0	09	02	26	FOR APPROVAL	PNB		
No.	YY	MM	DD	REVISION DESCRIPTION	BY		
	DATE						



CATCH BASIN

CATCH BASIN MANHOLE

NOTES:

1. PRE-CAST CONCRETE PRODUCTS TO BE LAFARGE, PRECON, INLAND OR APPROVED EQUAL.

2. NON SHRINK GROUT FOR FINAL BRICK ADJUSTMENTS AND INSTALLATIONS OF LEADS SHALL BE IN ACCORDANCE WITH SECTION 03300 CAST-IN-PLACE CONCRETE.

3. CATCH BASIN LEAD MUST PROTRUDE BETWEEN 50mm AND 100mm FROM THE INSIDE WALL OF CATCH BASIN OR MANHOLE.

4. ALL UNITS SHOWN IN mm UNLESS OTHERWISE NOTED.

5. FINAL CATCH BASIN ADJUSTMENTS SHALL BE IN ACCORDANCE WITH SECTION 03150 STORM MANHOLES AND CATCH BASINS.

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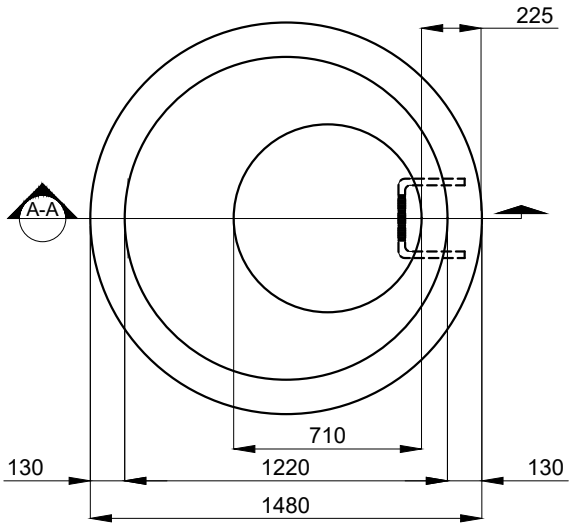
DRAWN: PNB
APPROVED:

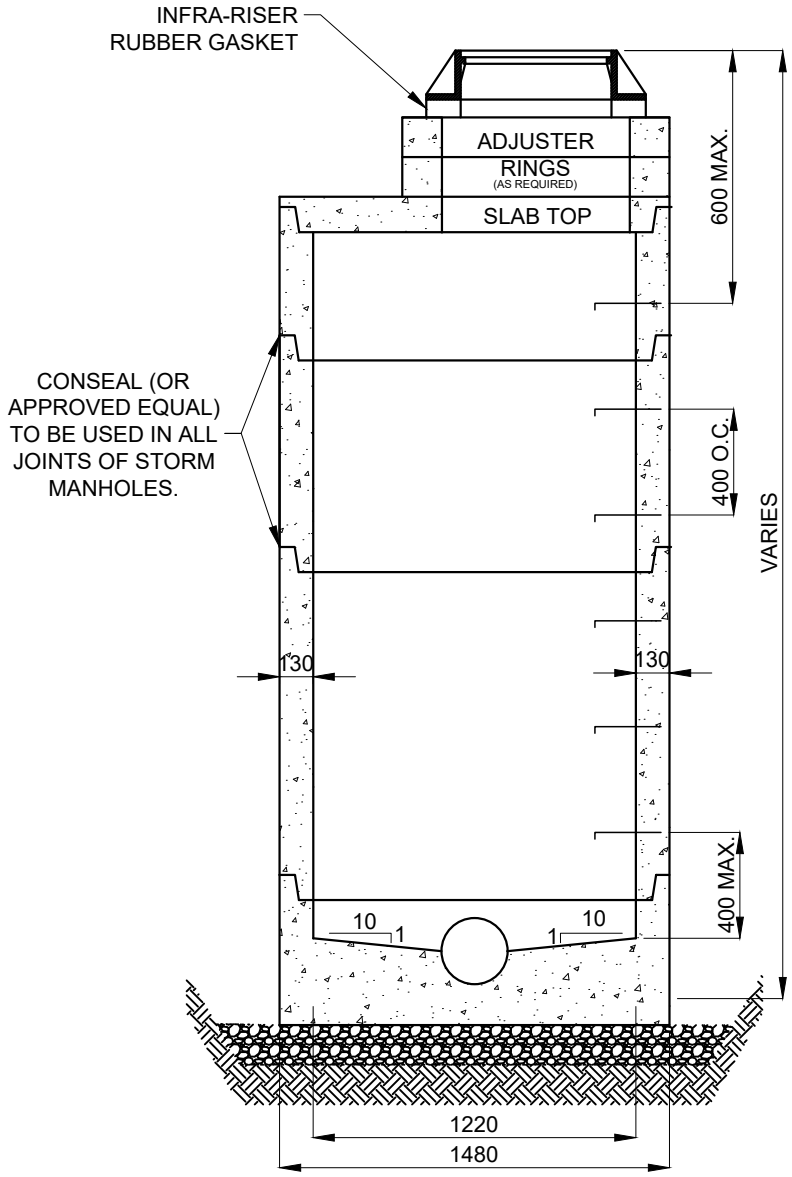
Medicine Hat
The Gas City

TWIN CATCH BASIN/ CATCH BASIN MANHOLE ASSEMBLY

DWG. No. ST 409 Rev. 2



PLAN VIEW



SECTION A-A

NOTES:

1. CONCRETE AND BENCHING MATERIALS SHALL BE IN ACCORDANCE WITH SECTION 03300 CAST-IN-PLACE CONCRETE.

2. PRECAST MANHOLE SECTIONS TO CONFORM TO ASTM DESIGNATION C478 (LATEST EDITION)

3. REINFORCED STEEL TO BE INTERMEDIATE GRADE fs = 140 MPa.

4. FRAMES AND COVERS TO HAVE MINIMUM WEIGHT OF 160 Kg / SET.

5. USE TYPE 1220 MANHOLE UP TO AND INCLUDING 600mm DIA. PIPE.

6. MANHOLE STEPS (RUNGS) TO BE ASTM C478 DROP STEP TYPE, PVC COATED ALUMINUM AND SHALL BE INSTALLED AT 400mm O.C..

7. ALL UNITS IN mm UNLESS OTHERWISE NOTED.

8. FINAL MANHOLE ADJUSTMENTS SHALL BE IN ACCORDANCE WITH SECTION 03150 STORM MANHOLES AND CATCH BASINS.

9. ALL MANHOLES SHALL BE PROVIDED WITH A HANDHOLD IMMEDIATELY BELOW THE FRAME AND ON THE SAME SIDE AS THE STEPS.

10. PRECAST MANHOLE BASES TO BE PRE-BENCHED

No.	YY	MM	DD	REVISION DESCRIPTION	BY
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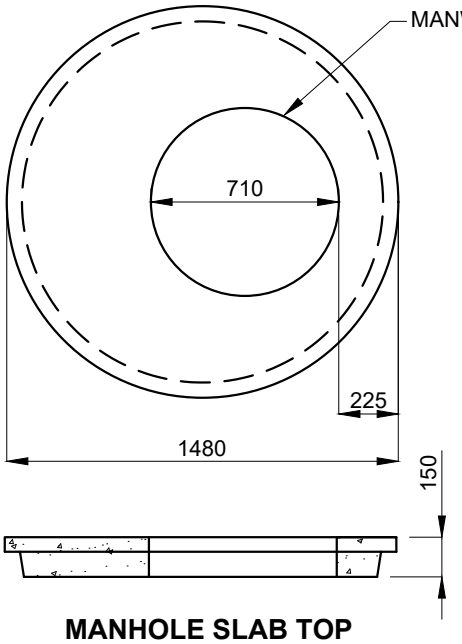
DRAWN: PNB
APPROVED:

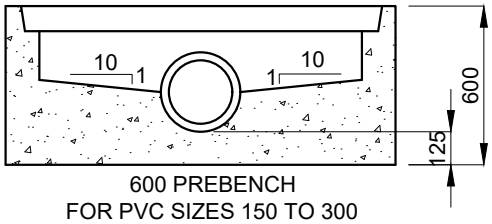
Medicine Hat
The Gas City

1200mm TYPE 5A
PRECAST MANHOLE
ASSEMBLY

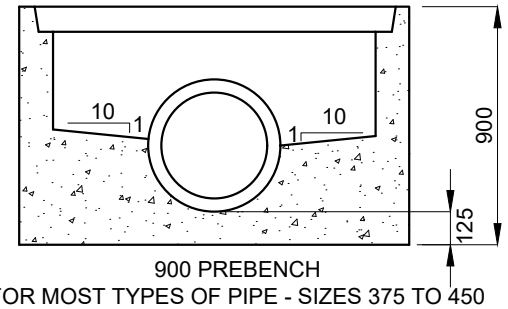
DWG. No. ST 410 Rev. 2



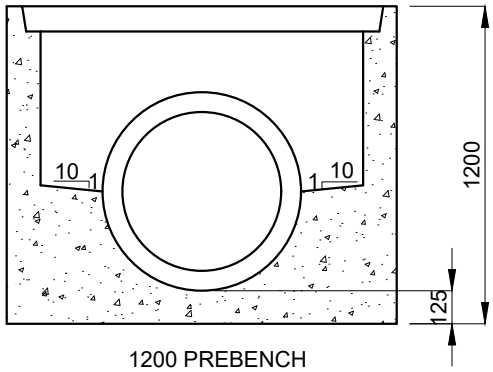
MANHOLE SLAB TOP



600 PREBENCH
FOR PVC SIZES 150 TO 300

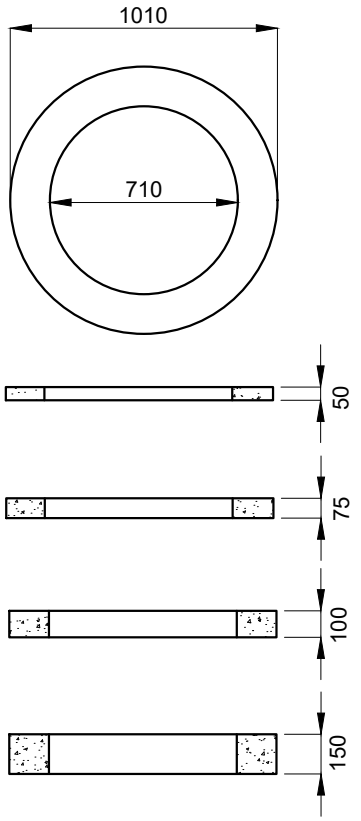


900 PREBENCH
FOR MOST TYPES OF PIPE - SIZES 375 TO 450

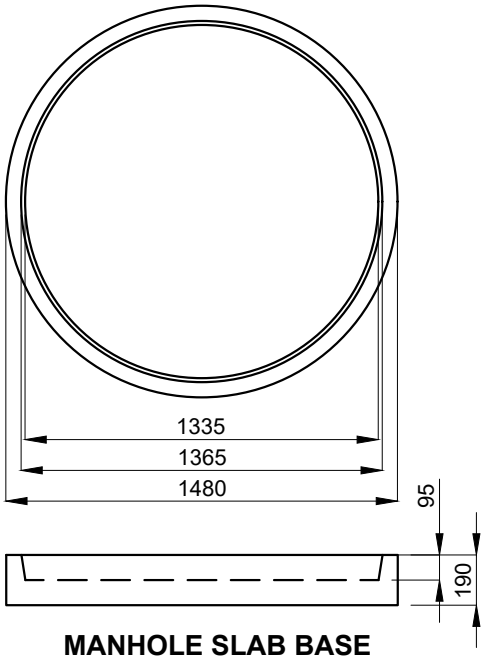


1200 PREBENCH
FOR MOST TYPES OF PIPE - SIZES 525 TO 600

PREBENCHED MANHOLE BASES



CONCRETE ADJUSTER RINGS



MANHOLE SLAB BASE

No.	YY	MM	DD	REVISION DESCRIPTION	BY
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1	15	01	20	TITLEBLOCK/FONT/DWG NUMBER	PMD
0	09	02	26	FOR APPROVAL	PNB

DATE

DATE: 01/15/09
SCALE: NTS
DRAWN: PNB
APPROVED:

Medicine Hat
The Gas City

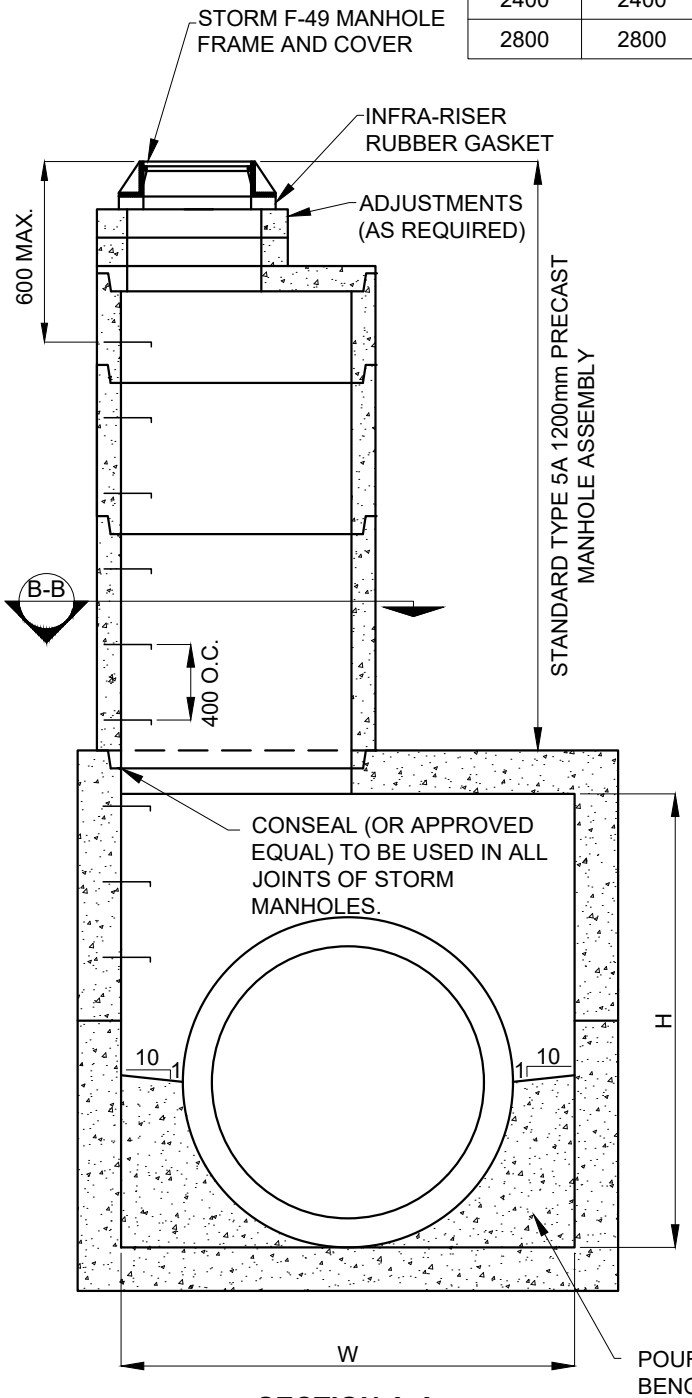
MANHOLE BASES, SLAB TOP & CONCRETE ADJUSTER RINGS

DWG. No. ST 411 Rev. 2

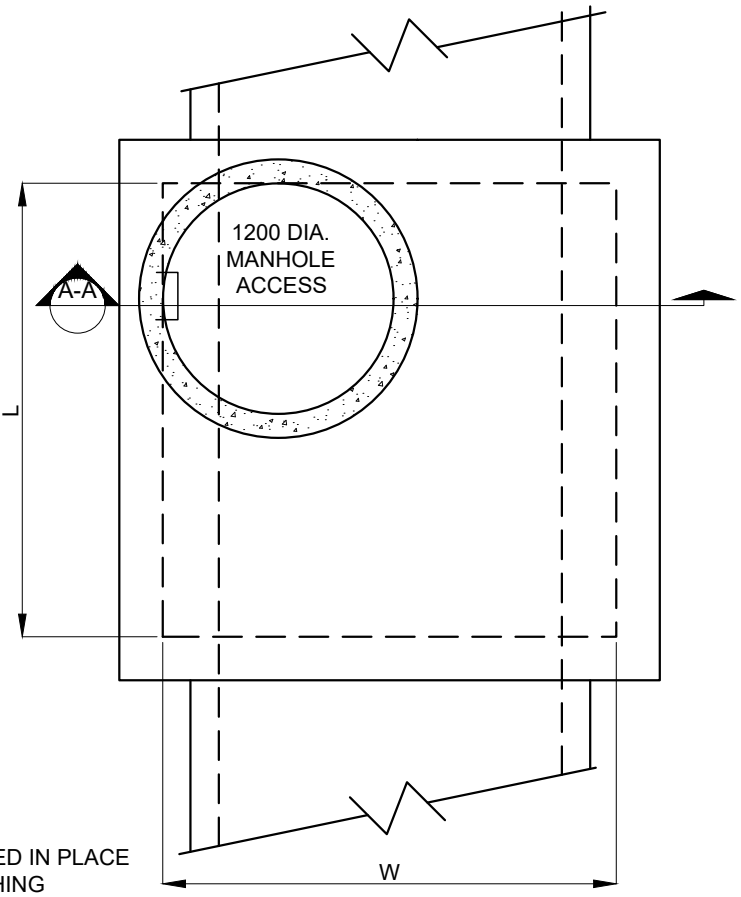
VAULT NOMINAL INSIDE DIMENSIONS (mm)		
LENGTH L	WIDTH W	HEIGHT H
1200	1200	2020
1500	1500	2020
1800	1800	2020
2400	2400	2400
2800	2800	2800

NOTES:

1. CONCRETE AND BENCHING MATERIALS SHALL BE IN ACCORDANCE WITH SECTION 03300 CAST-IN-PLACE CONCRETE.
2. PRECAST MANHOLE SECTIONS TO CONFORM TO ASTM DESIGNATION C478 (LATEST EDITION)
3. REINFORCED STEEL TO BE INTERMEDIATE GRADE fs=140 MPa.
4. FRAMES AND COVERS TO HAVE MINIMUM WEIGHT OF 160 Kg/SET.
5. MANHOLE STEPS (RUNGS) TO BE ASTM C47 DROP STEP TYPE, PVC COATEDALUMINUM AND SHALL BE INSTALLED AT 400mm O.C..
6. ALL UNITS IN mm UNLESS OTHERWISE NOTED.
7. FINAL MANHOLE ADJUSTMENTS SHALL BE IN ACCORDANCE WITH SECTION 03150 STORM MANHOLES AND CATCH BASINS.
8. ALL MANHOLES SHALL BE PROVIDED WITH A HANDHOLD IMMEDIATELY BELOW THE FRAME AND ON THE SAME SIDE AS THE STEPS.



SECTION A-A



SECTION B-B
PLAN VIEW

No.	YY	MM	DD	REVISION DESCRIPTION	BY
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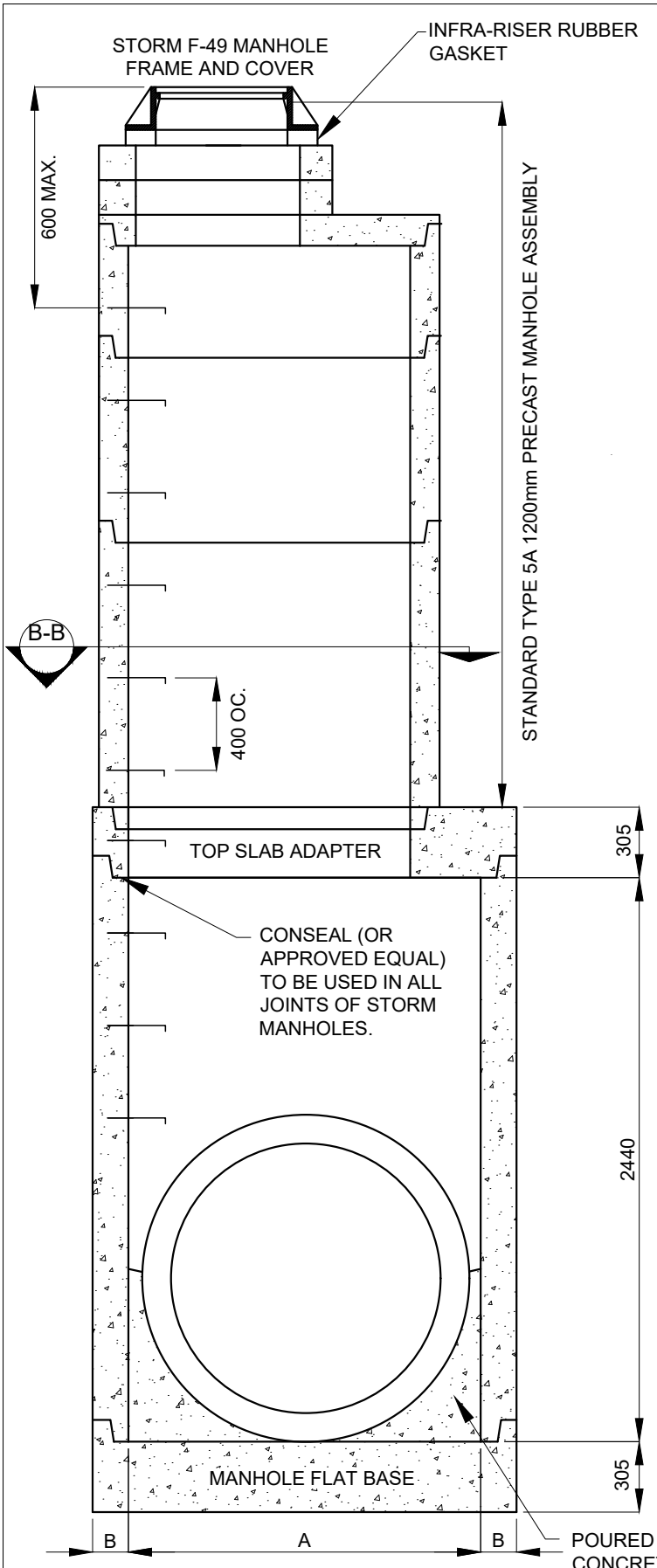
0	09	02	26	FOR APPROVAL	PNB

DATE: 02/11/09
SCALE: NTS
DRAWN: PNB
APPROVED:

Medicine Hat
The Gas City

TYPE 1–S PRECAST MANHOLE ASSEMBLY

DWG. No. ST 412 Rev. 2



SECTION A-A

NOTES:

1. CONCRETE AND BENCHING MATERIALS SHALL BE IN ACCORDANCE WITH SECTION 03300 CAST-IN-PLACE CONCRETE.

2. PRECAST MANHOLE SECTIONS TO CONFORM TO ASTM DESIGNATION C478 (LATEST EDITION)

3. REINFORCED STEEL TO BE INTERMEDIATE GRADE fs=140 MPa.

4. FRAMES AND COVERS TO HAVE MINIMUM WEIGHT OF 160 Kg/SET.

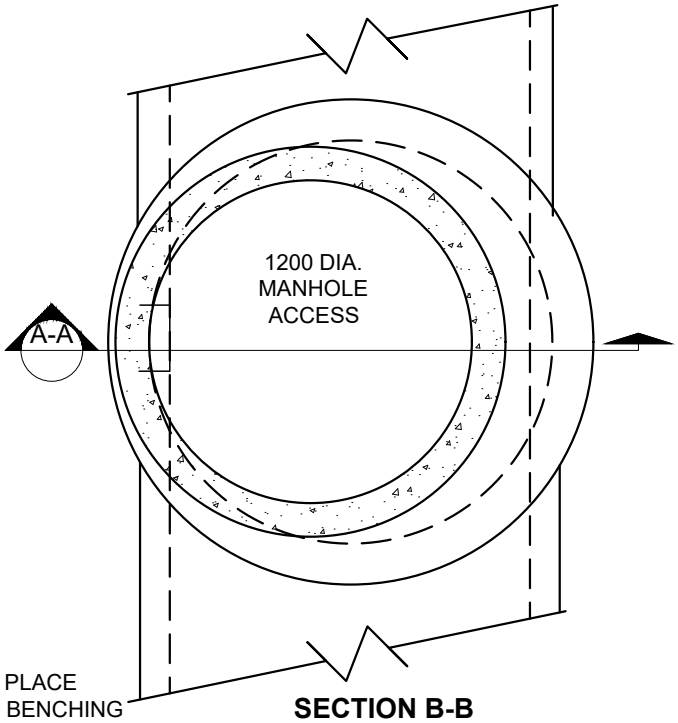
5. MANHOLE STEPS (RUNGS) TO BE ASTM C47 DROP STEP TYPE, PVC COATEDALUMINUM AND SHALL BE INSTALLED AT 400mm O.C..

6. ALL UNITS IN mm UNLESS OTHERWISE NOTED.

7. FINAL MANHOLE ADJUSTMENTS SHALL BE IN ACCORDANCE WITH SECTION 03150 STORM MANHOLES AND CATCH BASINS.

8. ALL MANHOLES SHALL BE PROVIDED WITH A HANDHOLD IMMEDIATELY BELOW THE FRAME AND ON THE SAME SIDE AS THE STEPS.

DIMENSIONS (mm)	
A	B
INSIDE DIAMETER	WALL THICKNESS
1372	140
1524	155
1678	165
1829	178
2134	203
2438	229
3048	279



SECTION B-B
PLAN VIEW

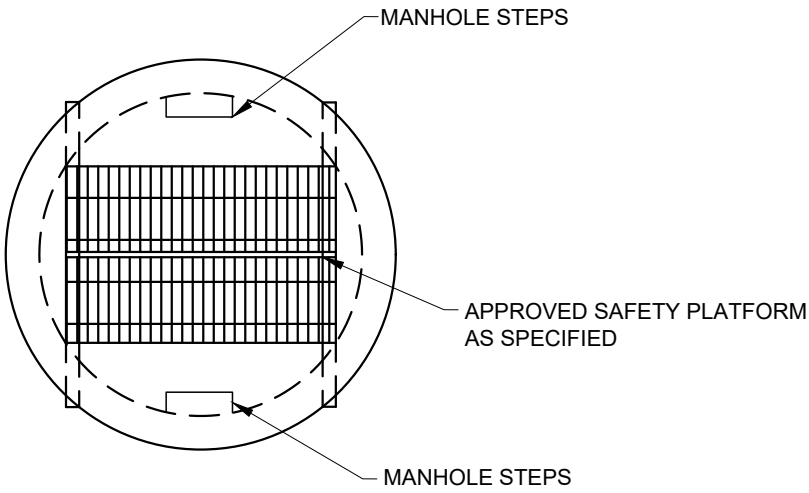
No.	YY	MM	DD	REVISION DESCRIPTION	BY
2	23	04	04	SPECIFICATION AUTHENTICATION	SP
1	15	01	20	TITLEBLOCK/FONT/DWG NUMBER	PMD
0	09	02	26	FOR APPROVAL	PNB

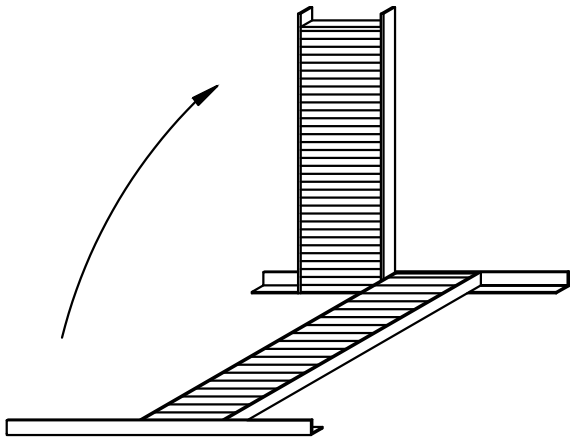
DATE: 02/23/09
SCALE: NTS
DRAWN: PNB
APPROVED:

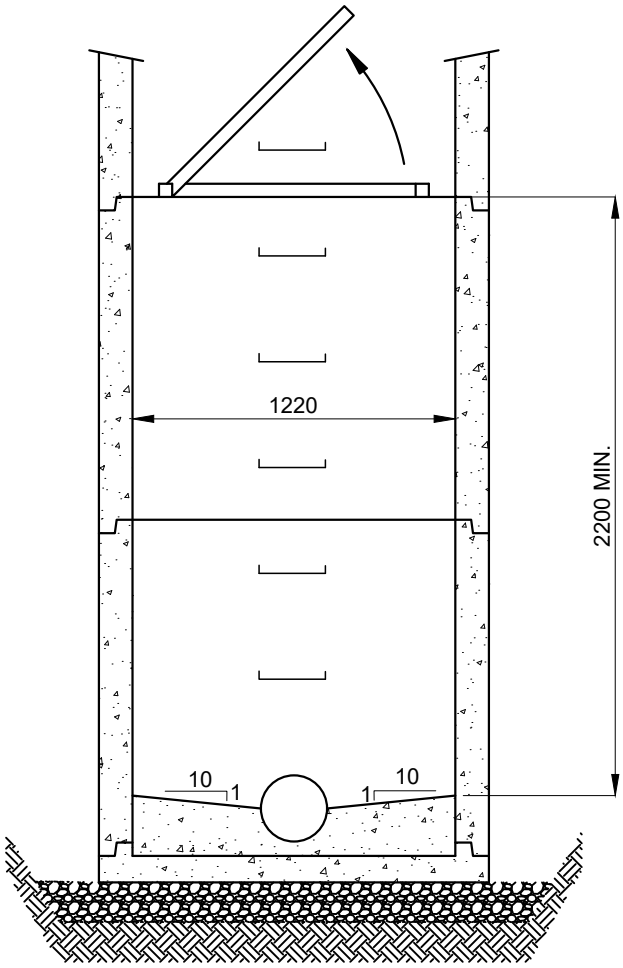
Medicine Hat
The Gas City

1500–3000mm LARGE DIAMETER MANHOLE ASSEMBLY

DWG. No. ST 413 Rev. 2







NOTES:

1. TO BE INSTALLED ON MANHOLES GREATER THAN 6.0m DEEP.

2. MAXIMUM SPACING BETWEEN PLATFORMS TO BE 6.0m.

3. TO BE INSTALLED ACCORDING TO MANUFACTURER'S RECOMMENDATIONS.

4. TO BE MADE OF HIGH-GRADE, LIGHTWEIGHT ALUMINUM WITH STAINLESS STEEL HARDWARE.

5. BOLT-ON OR CAST-IN-PLACE

No.	YY	MM	DD	REVISION DESCRIPTION	BY
2	23	04	04	SPECIFICATION AUTHENTICATION	SP
1	15	01	20	TITLEBLOCK/FONT/DWG NUMBER	PMD
0	09	02	26	FOR APPROVAL	PNB

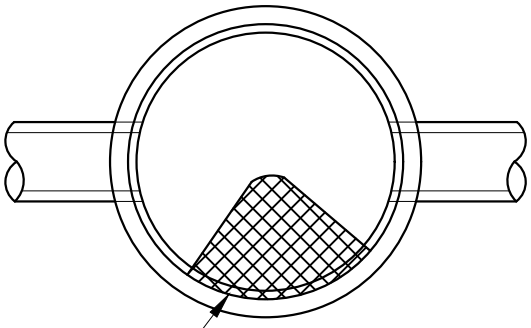
DATE

DATE: 02/11/09
SCALE: NTS
DRAWN: PNB
APPROVED:

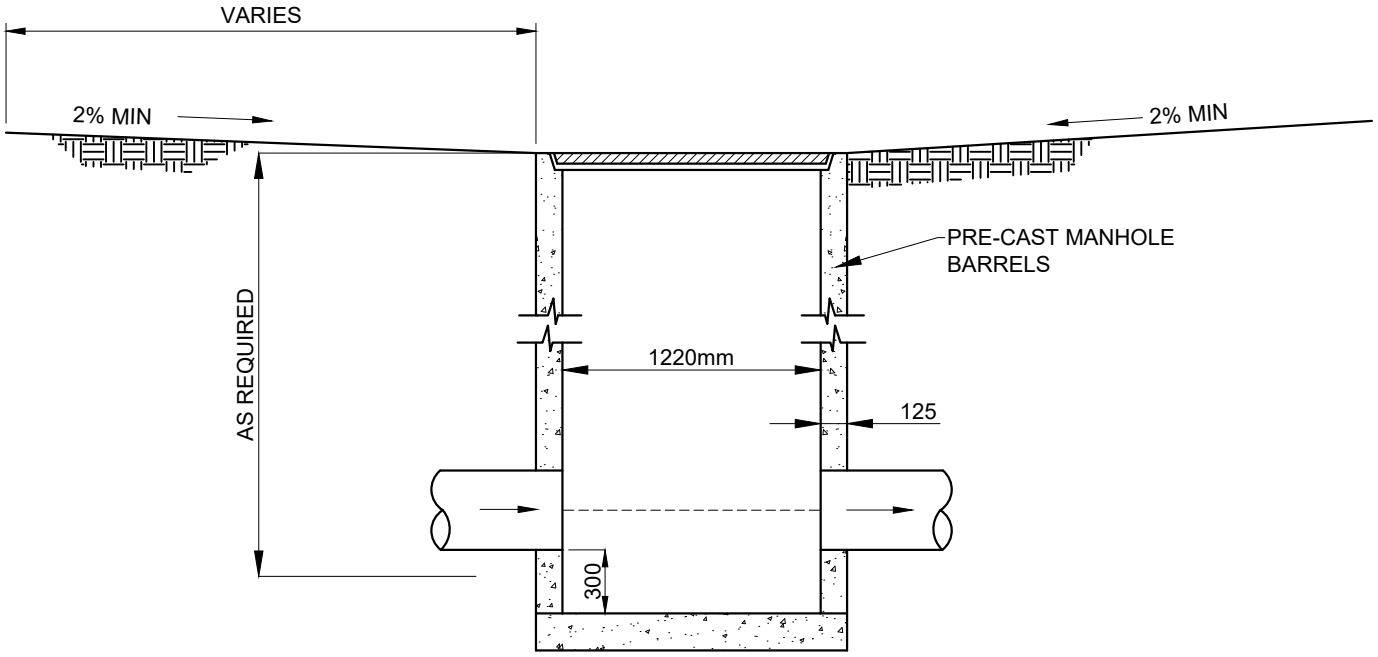
Medicine Hat
The Gas City

MANHOLE SAFETY PLATFORM

DWG. No. ST 414 Rev. 2



1300Ø ARMTEC TYPE 'V' RIVETED GRATING
3-¾" X 3/16" B.B.
BANDED GALVANIZED
OR APPROVED EQUAL



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2	23	04	04	SPECIFICATION AUTHENTICATION	SP
1	15	01	20	TITLEBLOCK/FONT/DWG NUMBER	PMD
0	09	02	26	FOR APPROVAL	PNB

DATE

DATE: 02/11/09
SCALE: NTS
DRAWN: PNB
APPROVED:

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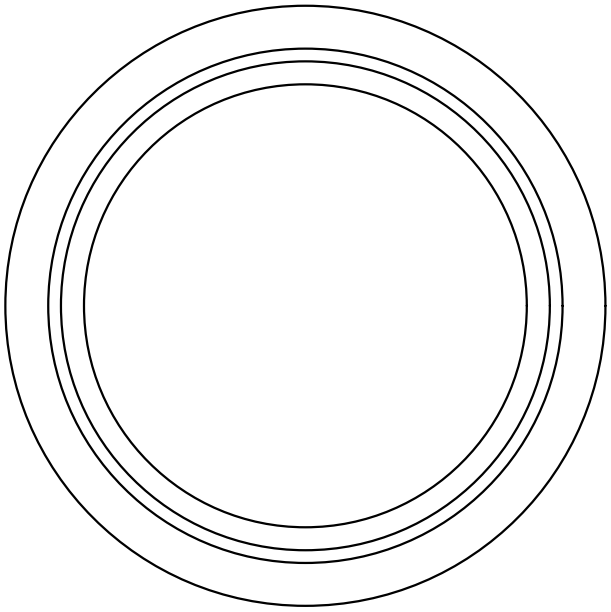
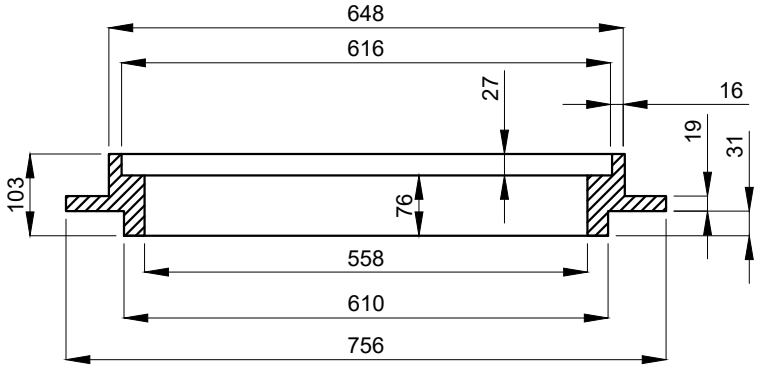
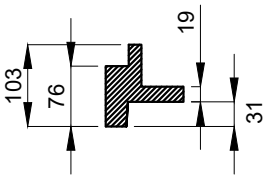
The Gas City

MANICURED PARKS
CATCH BASIN

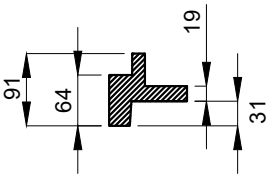
DWG. No. ST 415 Rev. 2



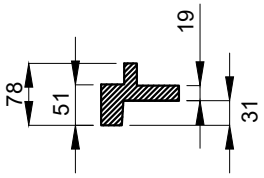




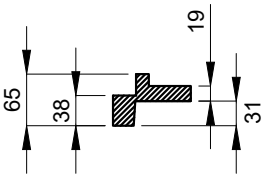
76mm RING



64mm RING



51mm RING



38mm RING

No.	YY	MM	DD	REVISION DESCRIPTION	BY
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1	15	01	20	TITLEBLOCK/FONT/DWG NUMBER	PMD
0	09	02	26	FOR APPROVAL	PNB

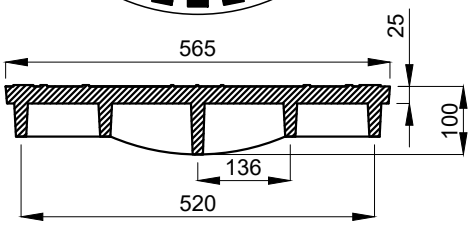
DATE

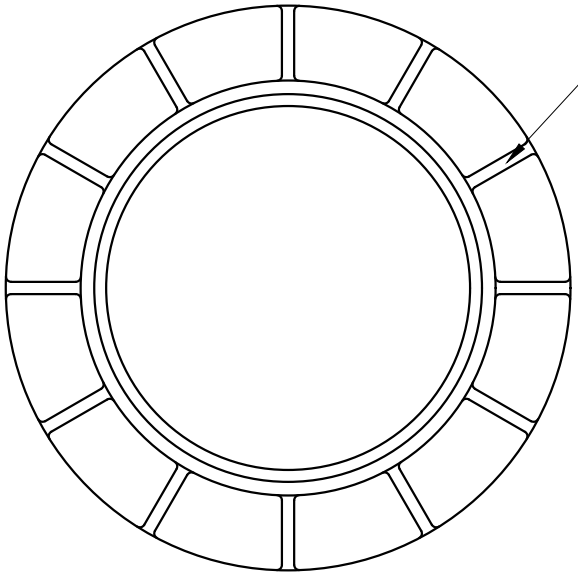
DATE: 02/11/09
SCALE: NTS
DRAWN: PNB
APPROVED:

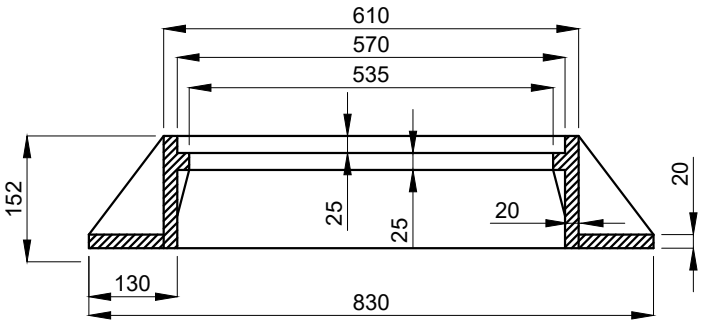
Medicine Hat
The Gas City

F-49 STORM SEWER MANHOLE STEEL RISER FRAME RINGS

DWG. No. ST 416 Rev. 2







No.	YY	MM	DD	REVISION DESCRIPTION	BY
2	23	04	04	SPECIFICATION AUTHENTICATION	SP
1	15	01	20	TITLEBLOCK/FONT/DWG NUMBER	PMD
0	09	02	26	FOR APPROVAL	PNB

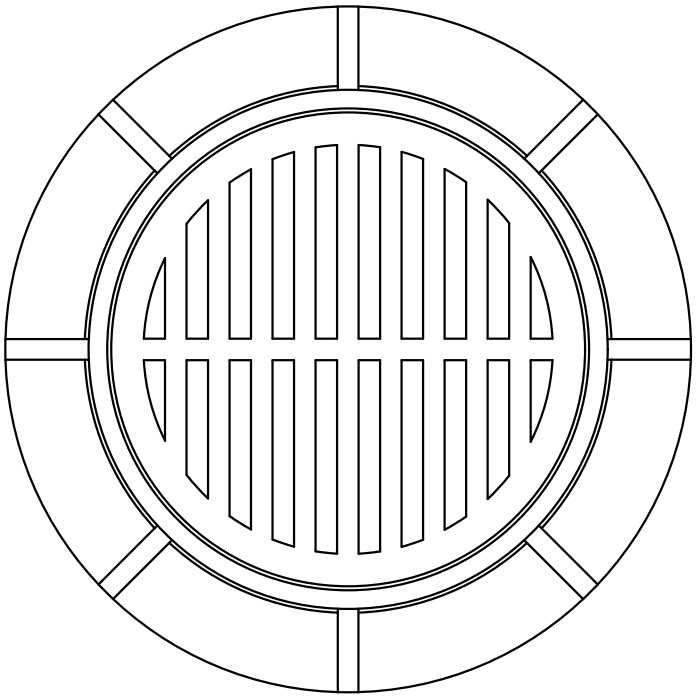
DATE

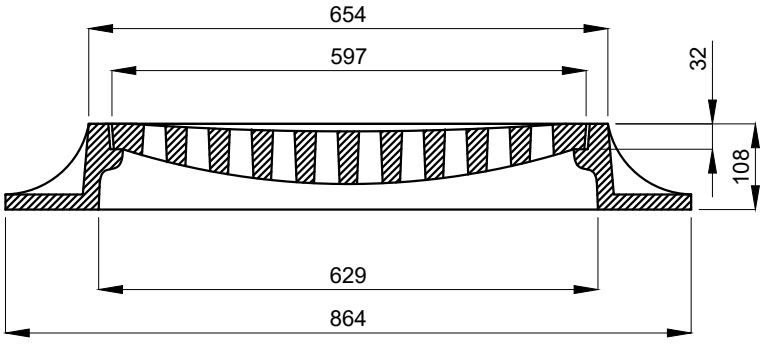
DATE: 02/11/09
SCALE: NTS
DRAWN: PNB
APPROVED:

Medicine Hat
The Gas City

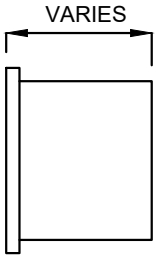
STANDARD F–49 MANHOLE FRAME AND COVER

DWG. No. ST 417 Rev. 2

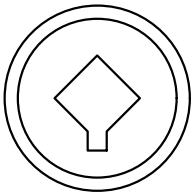




						DATE: 02/11/09	Medicine Hat The Gas City
						SCALE: NTS	F-68 OPEN GRATE MANHOLE FRAME AND COVER
2	23	04	04	SPECIFICATION AUTHENTICATION	SP	DRAWN: PNB	
1	15	01	20	TITLEBLOCK/FONT/DWG NUMBER	PMD	APPROVED:	DWG. No. ST 418 Rev. 2
0	09	02	26	FOR APPROVAL	PNB		
No.	YY	MM	DD	REVISION DESCRIPTION	BY		
	DATE						



SIDE VIEW

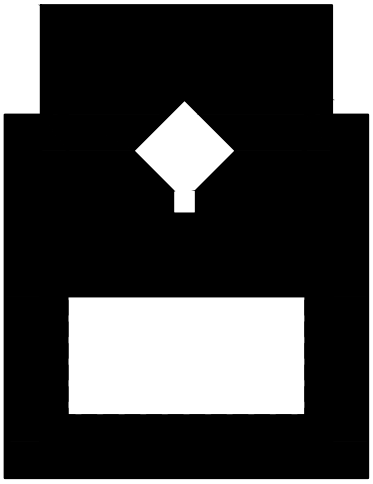


FRONT VIEW

"PLUG" ICD

NOTES:

A SHORT SLIGHTLY TAPERED PLUG IS INSERTED IN THE OUTLET PIPE FROM THE CATCH BASIN. IT IS HELD IN PLACE PLACE BY FRICTION AND HYDROSTATIC PRESSURE. PLUG ICD'S ARE MADE TO FIT 200mm, 250mm, & 300mm PIPE MADE FROM ANY MATERIAL. THE ORIFACE PLATE SITS FLUSH WITH THE INSIDE OF THE CATCH BASIN.



FRONT VIEW

"FRAMED" ICD

NOTES:

A PLATE CONTAINING THE ORIFACE IS HELD IN CHANNELS IN THE FRAME. THE ICD FRAME IS BOLTED OVER THE OUTLET PIPE INSIDE THE CATCH BASIN. FRAMED ICD'S CAN BE FABRICATED TO FIT ANY SIZE AND TYPE OF PIPE.

No.	DATE YY	MM	DD	REVISION DESCRIPTION	BY
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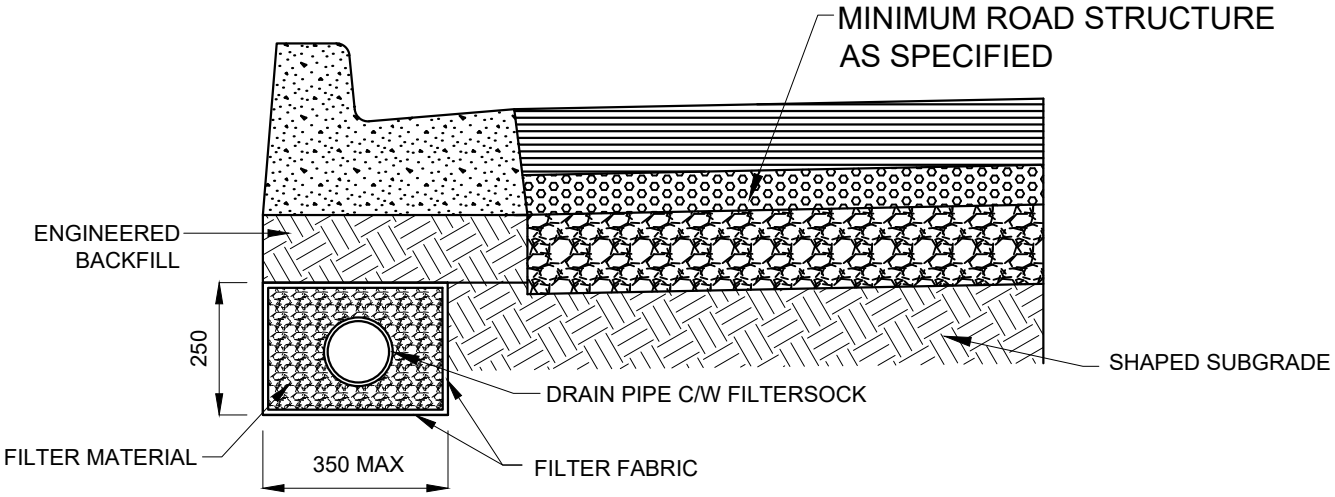
1	15	01	20	TITLEBLOCK/FONT/DWG NUMBER	PMD
0	09	02	26	FOR APPROVAL	PNB

DATE: 02/26/09
SCALE: NTS
DRAWN: PNB
APPROVED:

Medicine Hat
The Gas City

INLET CONTROL DEVICE (ICD)

DWG. No. ST 419 Rev. 2



NOTES:

1. MATERIALS IN ACCORDANCE WITH SECTION 02620 SUB-DRAIN SYSTEMS

2. NON SHRINK GROUT FOR CONNECTION OF SUB-DRAIN TO CATCHBASIN OR MANHOLE SHALL BE IN ACCORDANCE WITH SECTION 03300 CAST-IN-PLACE CONCRETE.

3. SUB-DRAIN SYSTEM MUST PROTRUDE BETWEEN 50mm AND 100mmFROM THE INSIDE WALL OF CATCH BASIN OR MANHOLE.

4. CONNECTING HOLE TO CATCH BASIN OR MANHOLE MUST BE CORED TO A DIAMETER NO GREATER THAN 50 mm OF THE NOMINAL SIZE OF PIPE AND MUST PROTRUDE 50-100mm INTO CATCH BASIN.

5. ALL UNITS ARE SHOWN IN mm UNLESS OTHERWISE NOTED.

6. SUB-DRAIN SYSTEM SLOPE SHALL BE INSTALLED TO THE SAME SLOPE AS THE LIP OF GUTTER GRADE OR AS DIRECTED BY THE ENGINEER.

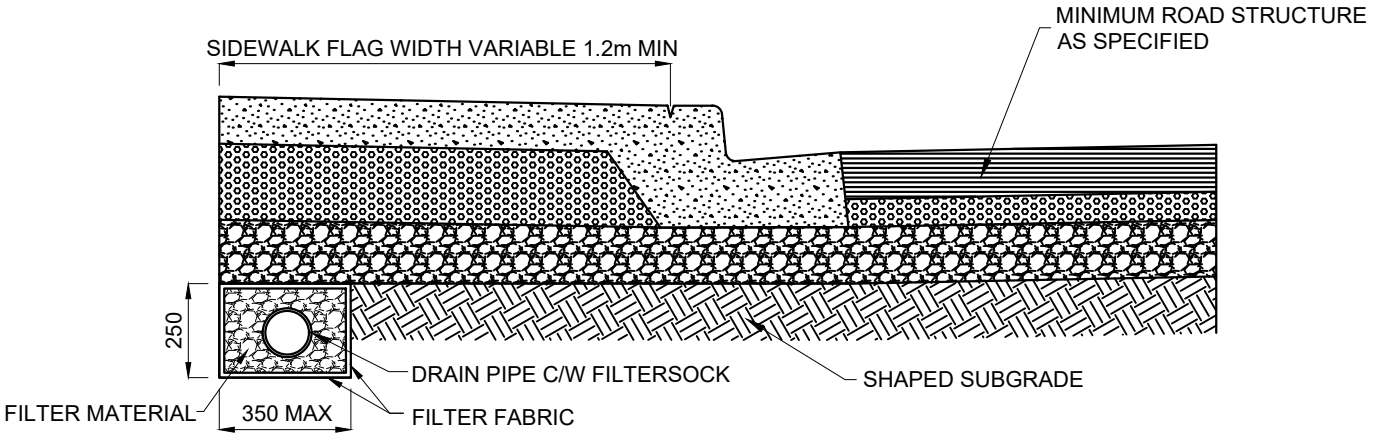
No.	DATE YY	MM	DD	REVISION DESCRIPTION	BY
2	23	04	04	SPECIFICATION AUTHENTICATION	SP
1	15	01	20	TITLEBLOCK/FONT/DWG NUMBER	PMD
0	09	02	26	FOR APPROVAL	PNB

DATE: 02/24/09
SCALE: NTS
DRAWN: PNB
APPROVED:

Medicine Hat
The Gas City

TYPICAL SUB-DRAIN SYSTEM INSTALLATION

DWG. No. ST 420 Rev. 2



NOTES:

1. MATERIALS IN ACCORDANCE WITH SECTION 02620 SUB-DRAIN SYSTEMS

2. NON SHRINK GROUT FOR CONNECTION OF SUB-DRAIN TO CATCHBASIN OR MANHOLE SHALL BE IN ACCORDANCE WITH SECTION 03300 CAST-IN-PLACE CONCRETE.

3. SUB-DRAIN SYSTEM MUST PROTRUDE BETWEEN 50mm AND 100mmFROM THE INSIDE WALL OF CATCH BASIN OR MANHOLE.

4. CONNECTING HOLE TO CATCH BASIN OR MANHOLE MUST BE CORED TO A DIAMETER NO GREATER THAN 50 mm OF THE NOMINAL SIZE OF PIPE.

5. ALL UNITS ARE SHOWN IN mm UNLESS OTHERWISE NOTED.

6. SUB-DRAIN SYSTEM SLOPE SHALL BE INSTALLED TO THE SAME SLOPE AS THE LIP OF GUTTER GRADE OR AS DIRECTED BY THE ENGINEER.

No.	YY	MM	DD	REVISION DESCRIPTION	BY
2	23	04	04	SPECIFICATION AUTHENTICATION	SP
1	15	01	20	TITLEBLOCK/FONT/DWG NUMBER	PMD
0	09	02	26	FOR APPROVAL	PNB

DATE

DATE: 02/24/09
SCALE: NTS
DRAWN: PNB
APPROVED:

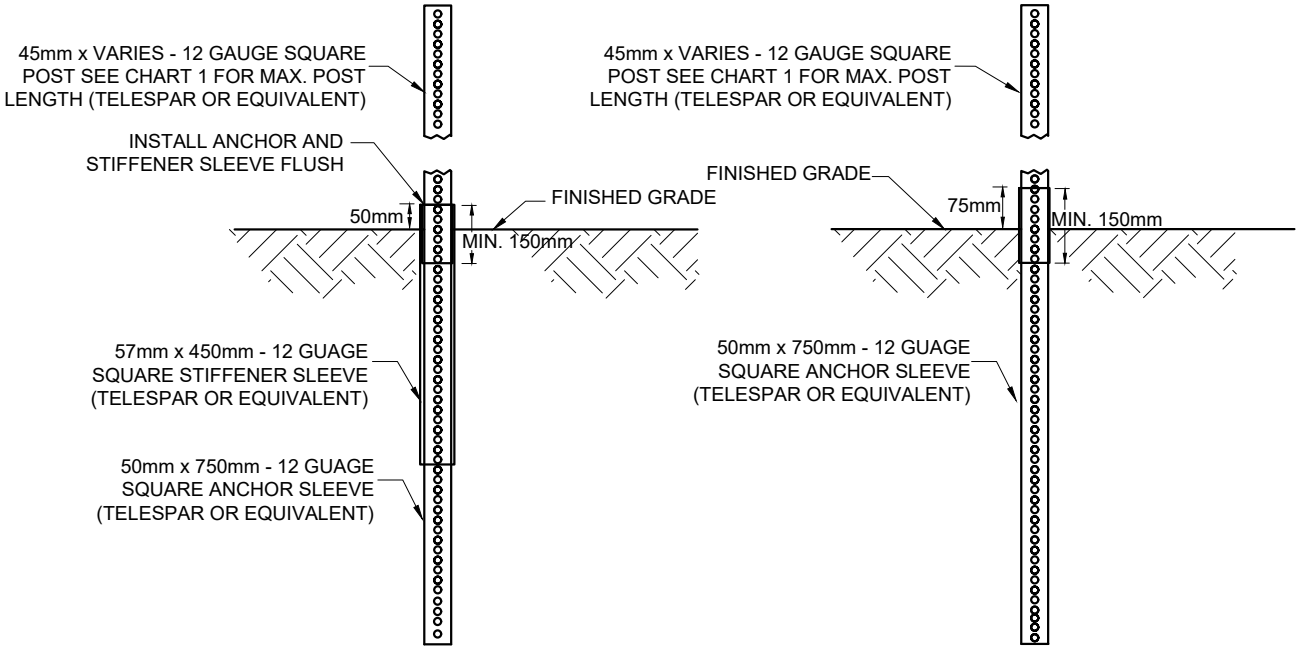
Medicine Hat
The Gas City

UNIFORM BACKFILL SUB-DRAIN SYSTEM INSTALLATION

DWG. No. ST 421 Rev. 2

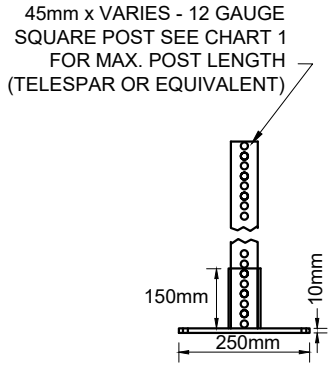
MW Construction Specification
Standard Detail Drawings

Part 2- Roads

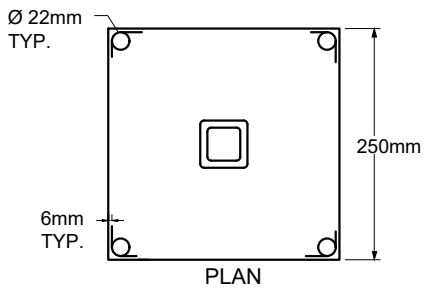


TYPE 1
3 PIECE SYSTEM

TYPE 2
2 PIECE SYSTEM



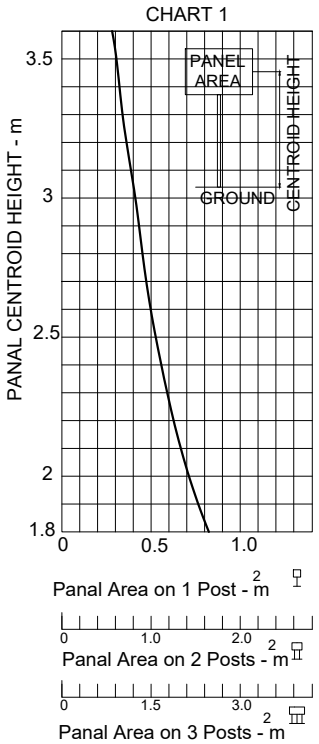
VERTICAL SECTION



PLAN

TYPE 3
BASE PLATE SYSTEM

CHART 1



NOTES:

-THE SLEEVES SHALL BE FREE OF ANY OBSTRUCTION TO ENSURE EASE OF INSTALLATION AND REMOVAL OF SIGNPOSTS.

- TYPE 3 ASSEMBLY SHALL ONLY BE INSTALLED WITH ANCHOR BOLTS AT LOCATIONS WHERE CONCRETE HAS ALREADY BEEN CASTED INTO PLACE.

- POST SHALL BE SECURED TO THE ASSEMBLY WITH THE PIN POINTING IN THE DIRECTION OF TRAFFIC FLOW.

- THE TOP OF THE SIGN POST SHALL NOT VARY FROM THE BOTTOM BY MORE THAN 5cm WHEN INSTALLED.

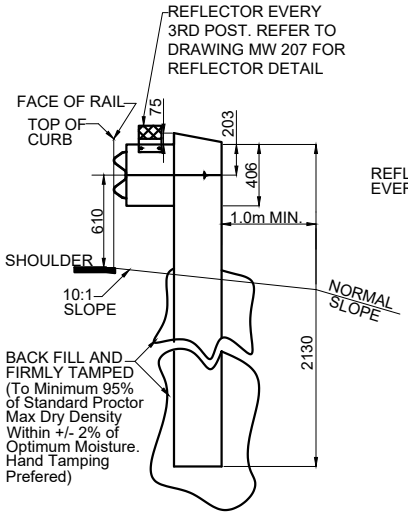
No.	DATE YY	MM	DD	REVISION DESCRIPTION	BY
2	23	04	04	SPECIFICATION AUTHENTICATION	SP
1	15	01	15	REVISIONS/DRAWING NUMBER CHANGE	PMD
0	09	03	18	FOR APPROVAL	PNB

DATE: 01/09/06
SCALE: NTS
DRAWN: C.B.
APPROVED:

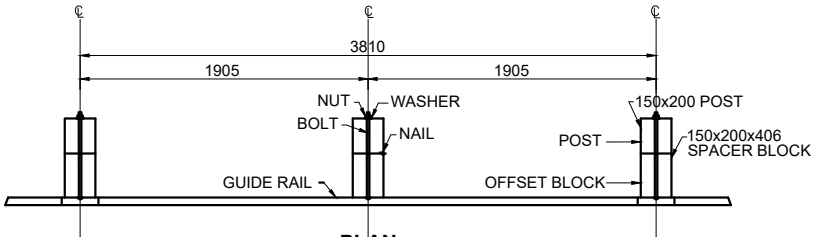
Medicine Hat
The Gas City

YIELDING BREAKAWAY SIGN POST ASSEMBLY

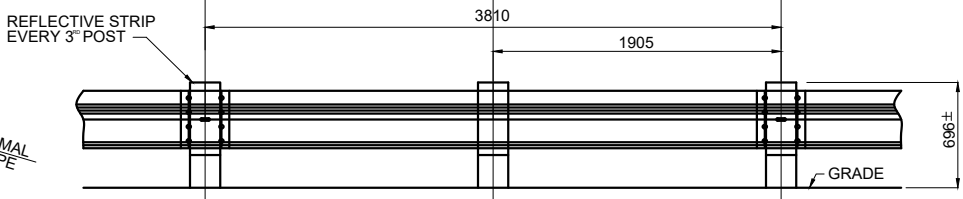
DWG. No. RD 200 Rev. 2



POST AND SPACER DETAILS

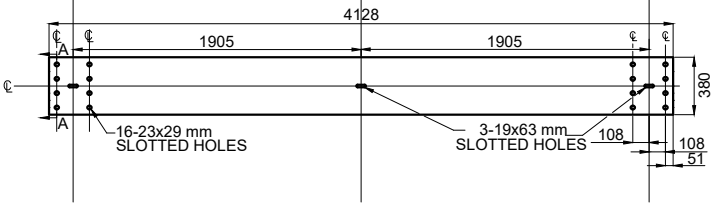


PLAN

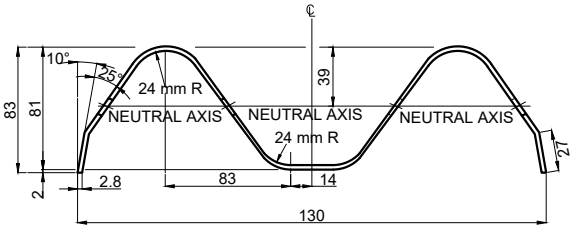


ELEVATION

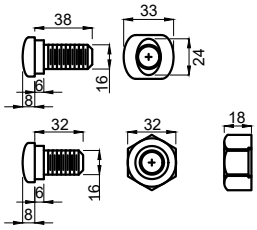
STEEL GUIDERAIL



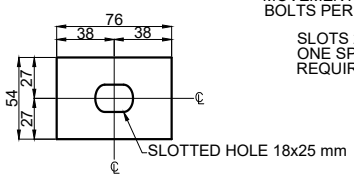
FRONT ELEVATION



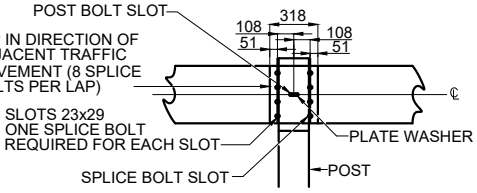
ENLARGED SECTION A-A



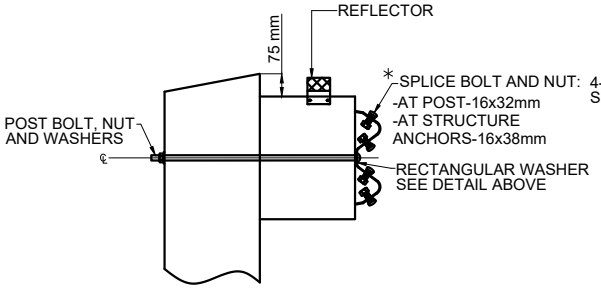
ENLARGED SPLICE BOLT AND NUT



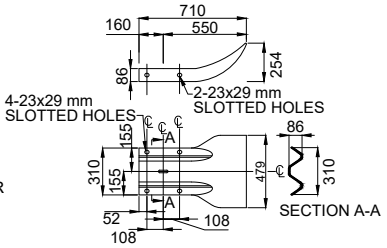
ENLARGED RECTANGULAR WASHER



RAIL SPLICE DETAIL



ENLARGED ARRANGEMENT AT POST



STANDARD TERMINAL SECTION

NOTES:
A. THICKNESS OF RAIL TO BE 2.8mm, RECTANGULAR WASHER 4.7mm, ROUND WASHERS 3.0mm THICK.
B. ALL DIMENSIONS SUBJECT TO MANUFACTURING TOLERANCES UNLESS OTHERWISE INDICATED.
C. ALL DIMENSIONS ARE IN MILLIMETRES OR METERS UNLESS OTHERWISE SHOWN.
D. THIS DWG. TO BE READ IN CONJUNCTION WITH MW 202.

TABLE OF SECTIONAL PROPERTIES* AND WEIGHT						
THICKNESS	AREA OF X-SECTION	MOMENT OF INERTIA (mm)⁴ HORIZONTAL	MOMENT OF INERTIA (mm)⁴ VERTICAL	SECTION MODULUS (mm)³ HORIZONTAL	SECTION MODULUS (mm)³ VERTICAL	WEIGHT OF GALVANIZED G.R. PER PIECE kg
2.8	1284 mm²	0.96 x 10⁶	12.5 x 10⁶	2.25 x 10⁴	8.03 x 10⁴	45.4

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1	15	01	15	REVISIONS/DRAWING NUMBER CHANGE	PMD
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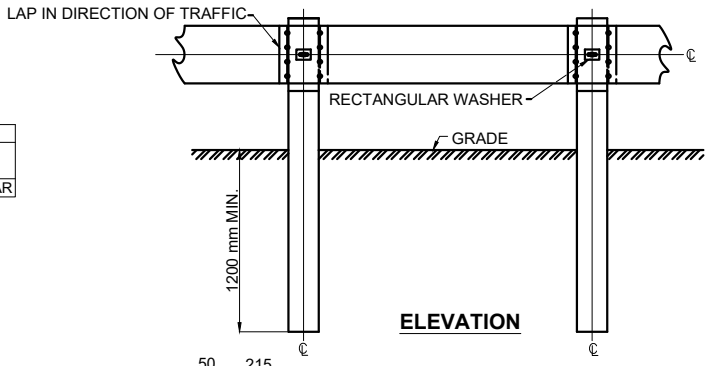
DATE: 01/09/06
SCALE: NTS
DRAWN: C.B.
APPROVED:

Medicine Hat
The Gas City

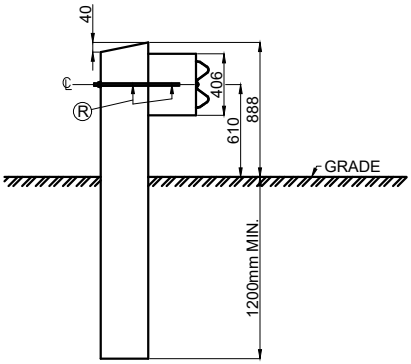
STEEL BEAM GUIDE RAIL
RAIL DETAILS

DWG. No. RD 201 Rev. 2

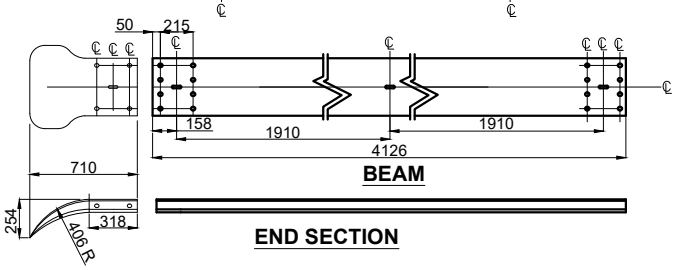
POST BOLT AND HOLE			
	HOLE DIA. (mm)	POST BOLT AND NUT	WASHER
Ⓡ	18	16 X 460	RECTANGULAR



ELEVATION

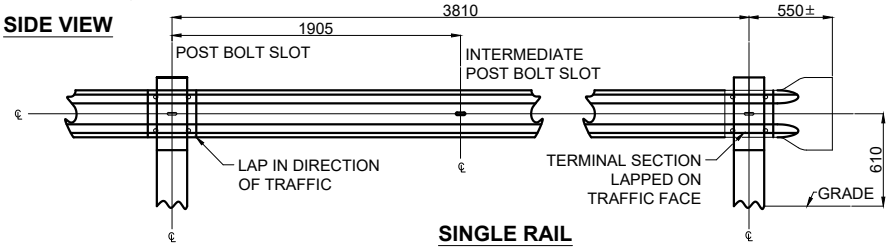


SIDE VIEW

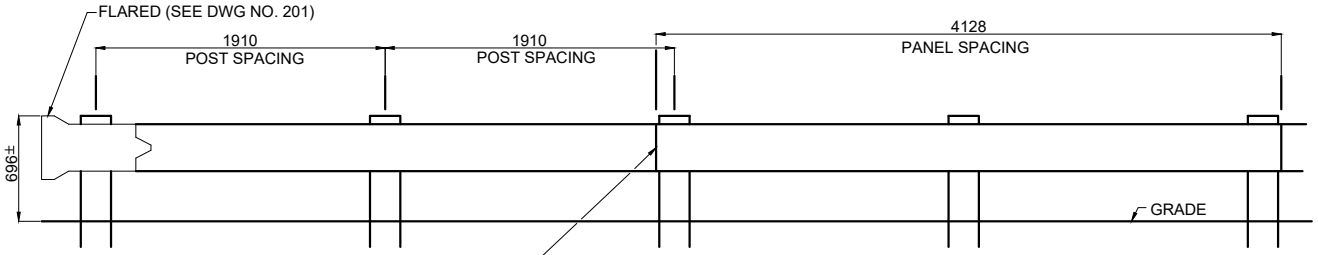


BEAM

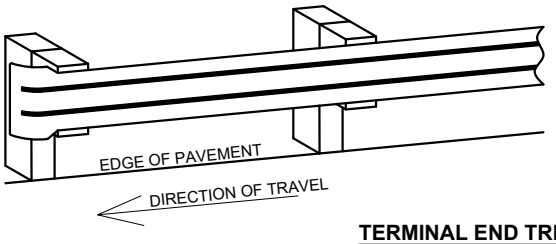
END SECTION

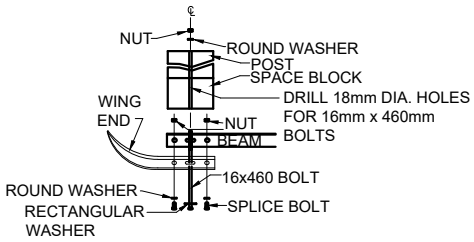


SINGLE RAIL



TYPICAL ELEVATION





TERMINAL END TREATMENT - WING END

NOTES:

1. WHERE GUIDE RAIL IS ADJACENT TO CURB, MOUNTING HEIGHT SHALL BE MEASURED:
   a. VERTICALLY AT FACE OF GUIDE RAIL WHEN FACE OF GUIDE RAIL IS MORE THAN 300MM BEYOND GUTTER LINE.
   b. VERTICALLY AT GUTTER LINE WHEN FACE OF GUIDE RAIL IS 300mm OR LESS BEYOND GUTTER LINE.

A. WOODEN POSTS AND OFFSET BLOCKS: SIZE 150X200MM NOMINAL, TOPS TO HAVE 25MM CHAMFER.
B. WOODEN POSTS TO BE SET BY INSTRUMENT FOR ALIGNMENT AND GRADE, WITH TOPS PARALLEL TO PAVEMENT GRADE.
C. TO PRODUCE ON EVEN ALIGNMENT, SHIM BEAM ELEMENT WHERE NECESSARY.
D. ALL DIMENSIONS ARE IN MILLIMETERS OR METERS UNLESS OTHERWISE SHOWN.
E. THIS DWG. TO BE READ IN CONJUNCTION WITH DWG. 201.

GUIDERAIL-INSTALLATION HARDWARE DETAILS		
HARDWARE	DESCRIPTION	LOCATION
POST BOLT	Rounded Head, Oval Shoulder, 16mm dia. Lengths 460mm. Galvanized	Connection of Guiderail and Channel to Wood.
SPLICE BOLT	See rail detail drawing. 16mm dia. Lengths-32, 38 and 51mm. Galvanized	Guiderail and Channel splices, End Sections.
NUTS	Hexagonal Flat on both sides. 16mm diameter. Galvanized	Post and Splice bolts.
RECTANGULAR WASHER	76x54x4.7 thick 25x18 slot, Galvanized.	With all nuts except for splices and on Guiderail face.

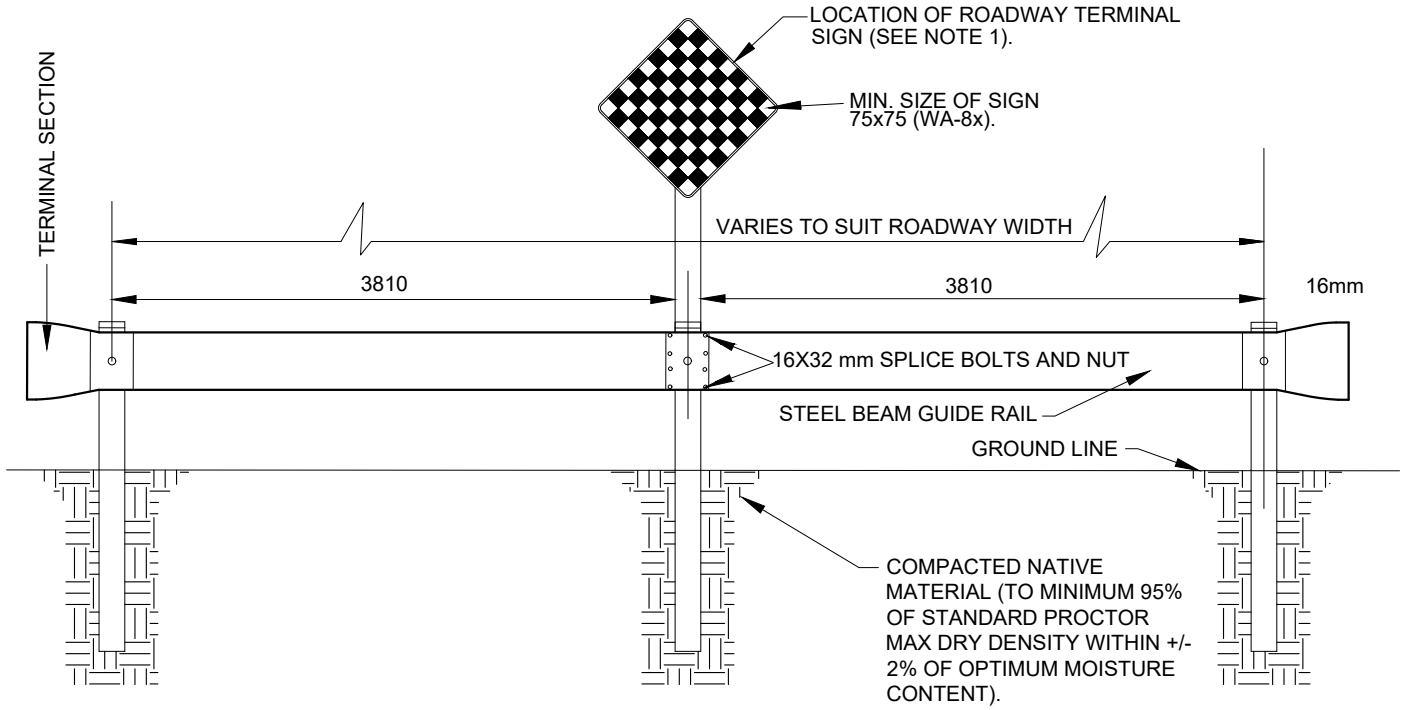
No.	DATE YY	MM	DD	REVISION DESCRIPTION	BY
2	23	04	04	SPECIFICATION AUTHENTICATION	SP
1	15	01	12	REVISIONS/DRAWING NUMBER CHANGE	PMD
0	09	03	18	FOR APPROVAL	PNB

DATE: 01/16/06
SCALE: NTS
DRAWN: C.B.
APPROVED:

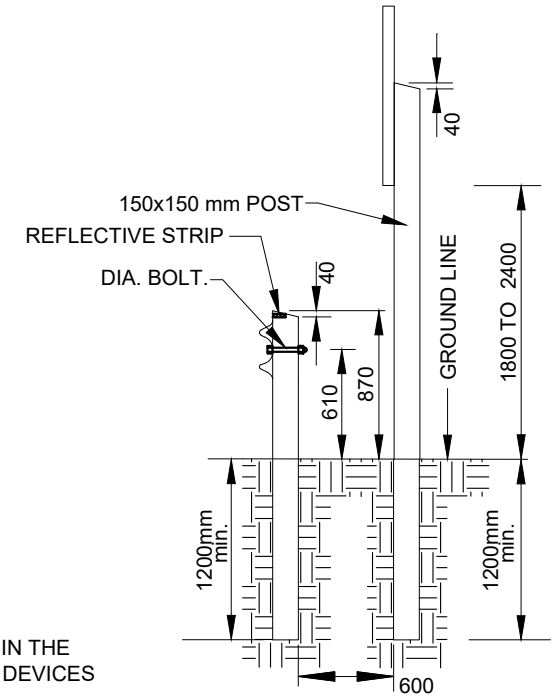
Medicine Hat
The Gas City

STEEL BEAM GUIDE RAIL ASSEMBLY DETAILS SINGLE RAIL

DWG. No. RD 202 Rev. 2



ELEVATION



SECTION

NOTES:
1. ROADWAY TERMINAL SIGN AS SPECIFIED IN THE MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES (WA-8x).
2. POSTS: SIZE 200 x 200mm NOMINAL, 190 x 190mm + 1.5mm DRESSED, TOPS TO HAVE 25mm CHAMFER, PRESSURE TREATED
3. ALL DIMENSIONS ARE IN MILLIMETERS OR METERS UNLESS OTHERWISE SHOWN.

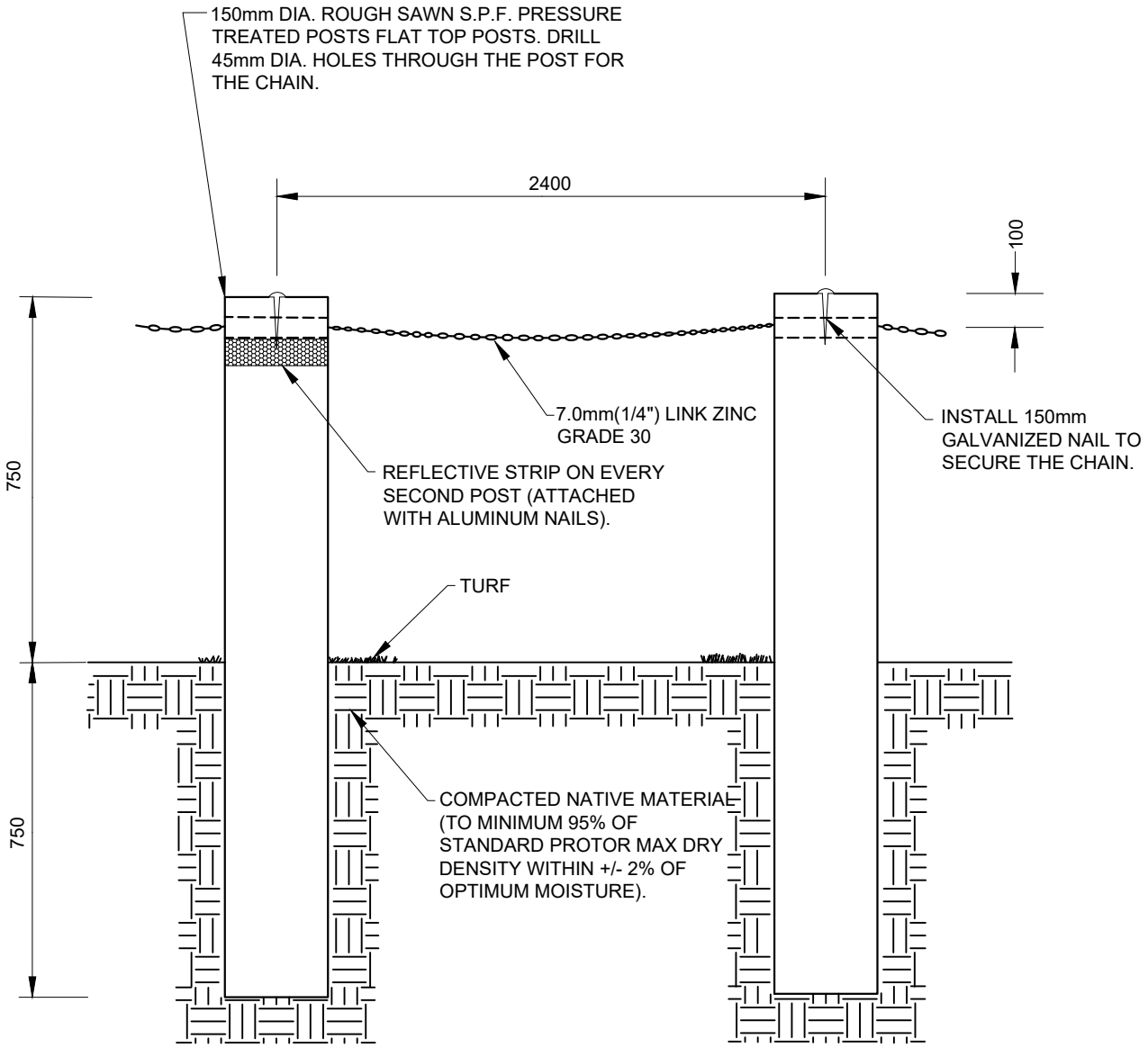
No.	YY	MM	DD	REVISION DESCRIPTION	BY
2	23	04	04	SPECIFICATION AUTHENTICATION	SP
1	15	01	15	DRAWING NAME CHANGE	PMD
0	09	03	18	FOR APPROVAL	PNB

DATE: 01/09/06
SCALE: NTS
DRAWN: C.B.
APPROVED:

Medicine Hat
The Gas City

DEAD END BARRICADE

DWG. No. RD 203 Rev. 2



NOTES:

1. CONTRACTOR TO CONTACT ALL UTILITY COMPANIES 48 HOURS IN ADVANCE OF CONSTRUCTION
2. ALL AREAS DISTURBED AS PART OF CONSTRUCTION ARE TO BE RE-SEEDED.
3. ALL MEASUREMENTS ARE IN MILLIMETERS.

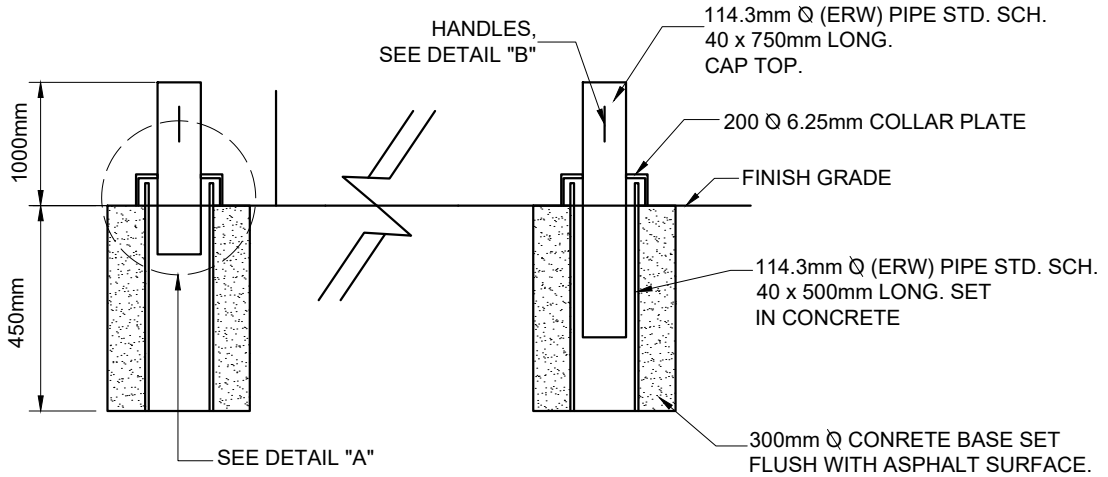
No.	YY	MM	DD	REVISION DESCRIPTION	BY
2	23	04	04	SPECIFICATION AUTHENTICATION	SP
1	15	01	15	DRAWING NAME CHANGE	PMD
0	09	03	18	FOR APPROVAL	PNB

DATE: 01/09/06
SCALE: NTS
DRAWN: C.B.
APPROVED:

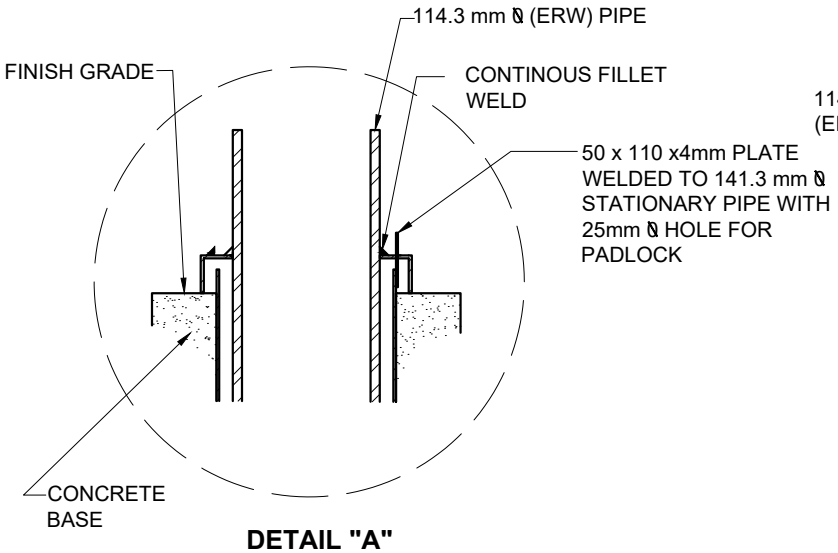
Medicine Hat
The Gas City

BOLLARD AND CHAIN

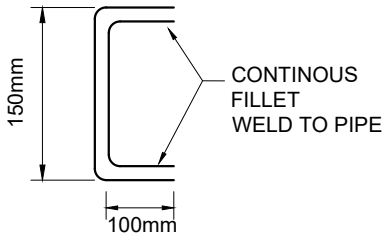
DWG. No. RD 204 Rev. 2



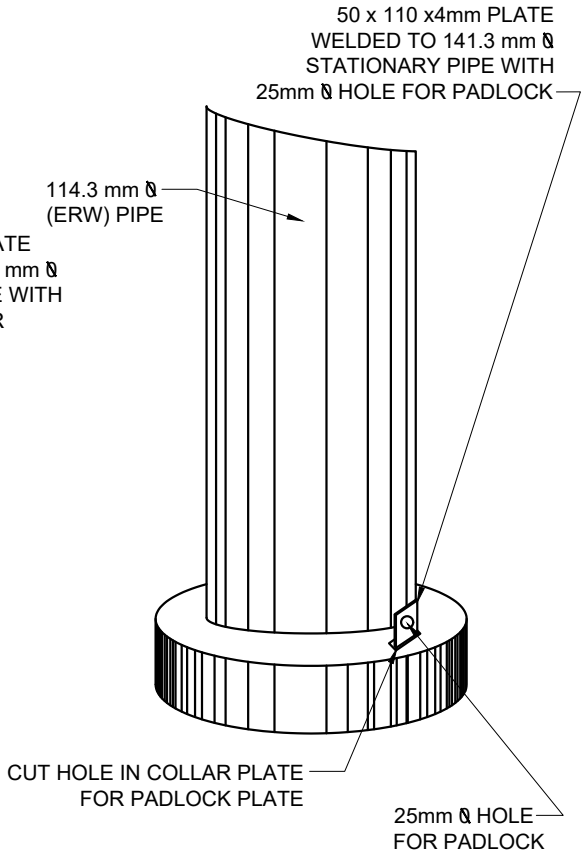
SECTION



DETAIL "A"



DETAIL "B"



NOTE:

COLLAR PLATE AND 114,3mm O.D.(ERW) PIPE ABOVE COLLAR PLATE, AND PADLOCK PLATE TO BE FINISH PAINTED BLACK. (EQUIVALENT TO RUSTOLEUM ENAMEL)
APRIL, 2002
NO SHARP EDGES

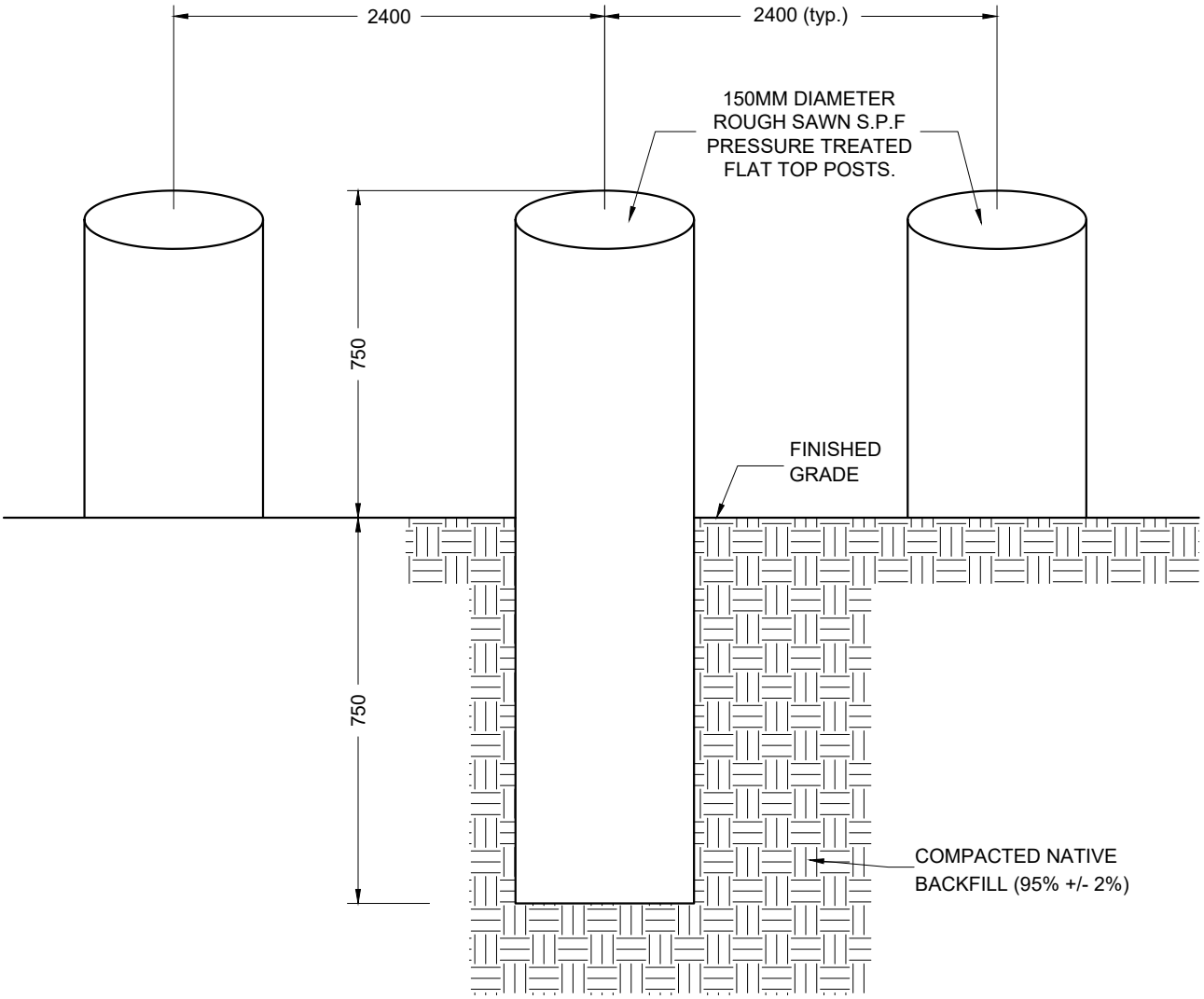
No.	YY	MM	DD	REVISION DESCRIPTION	BY
2	23	04	04	SPECIFICATION AUTHENTICATION	SP
1	15	01	19	NAME CHANGE	PMD
0	09	03	18	FOR APPROVAL	PNB

DATE: 01/16/06
SCALE: NTS
DRAWN: C.B.
APPROVED:

Medicine Hat
The Gas City

REMOVABLE STEEL BOLLARD DETAIL

DWG. No. RD 205 Rev. 2



ELEVATION

NOTES:
1. POSTS TO BE PRESSURE TREATED CONSTRUCTION GRADE TIMBER.
2. PRESSURE TREATMENT TO BE DOMTAR PENTA BROWN OR APPROVED EQUAL. ALL CUTS IN FIELD TO BE TREATED WITH SAME.
3. ALL DIMENSIONS IN MILLIMETERS.

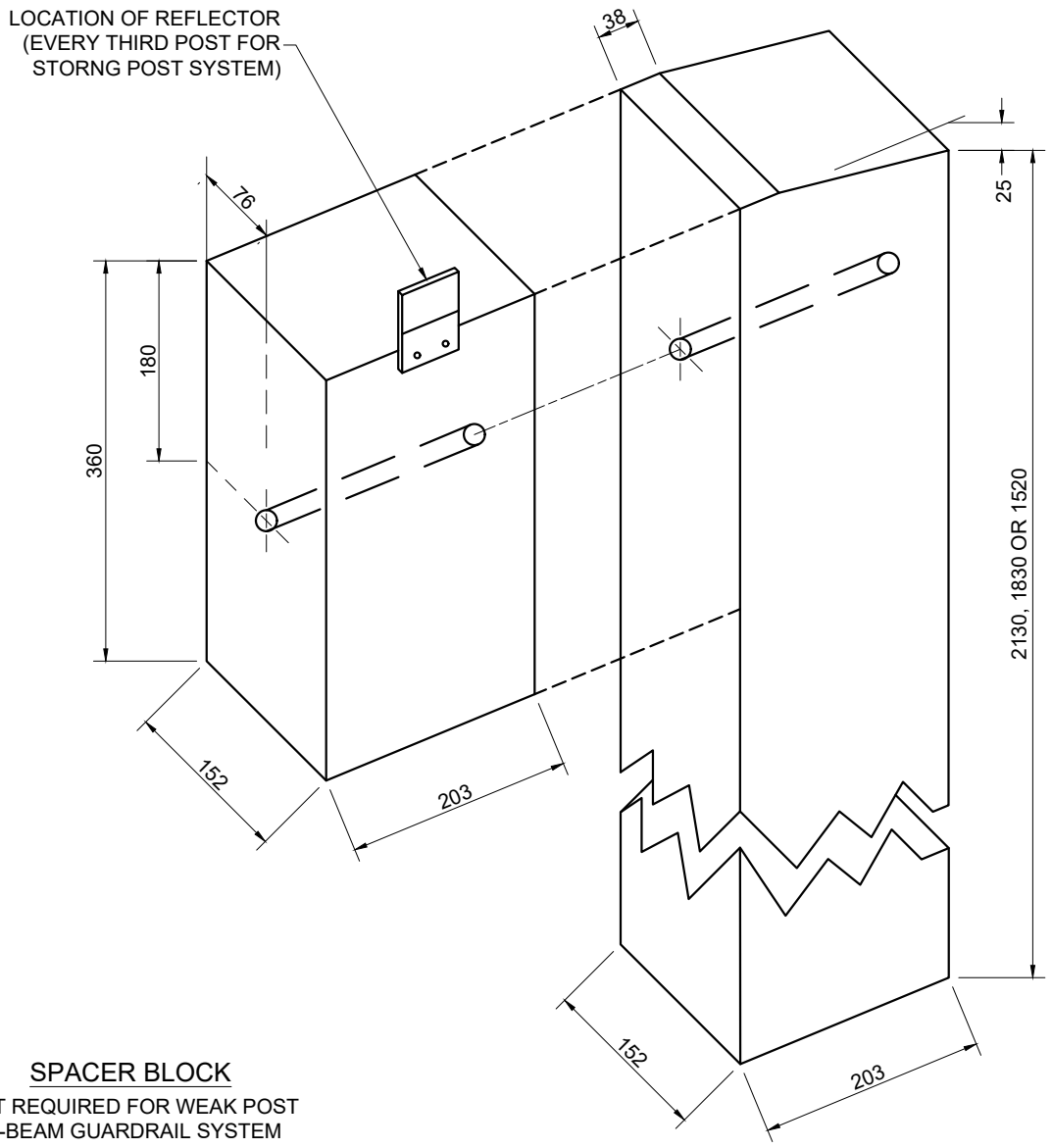
No.	YY	MM	DD	REVISION DESCRIPTION	BY
2	23	04	04	SPECIFICATION AUTHENTICATION	SP
1	15	01	19	NAME CHANGE	PMD
0	09	03	18	FOR APPROVAL	PNB

DATE: 01/09/06
SCALE: NTS
DRAWN: C.B.
APPROVED:

Medicine Hat
The Gas City

WOOD BOLLARD DETAIL (FLAT TOP)

DWG. No. RD 206 Rev. 2



SPACER BLOCK

NOT REQUIRED FOR WEAK POST
W-BEAM GUARDRAIL SYSTEM

POST

1520 (5'0"), 1830 (6'0"), or 2130 (7'0")

REFLECTOR

REFLECTOR COLOR IS EITHER FLOURESCENT YELLOW OR WHITE SUCH THAT IT COMPLIES WITH THE PRICIPLES FOR PAVEMENT EDGE LINES WITH RESPECT TO THEIR COLOR.

REFLECTOR IS DOUBLE SIDED SHEETING 108mm X 76mm (MINIMUM) WHICH SHALL MEET ASTM D4956, TYPE IX OR TYPE XI FOR LUMINANCE LEVEL. THE CONTRACTOR SHALL SELECT THE REFLECTOR FROM THE ALBERTA TRANSPORTATION PRODUCTS LIST.

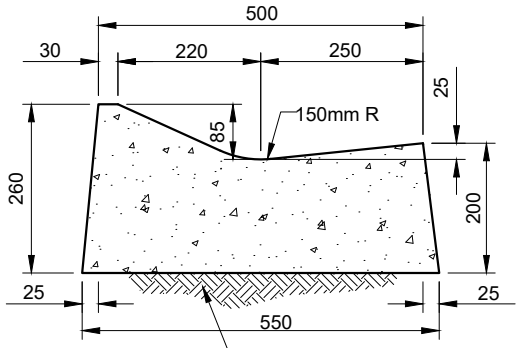
No.	YY	MM	DD	REVISION DESCRIPTION	BY
1	23	04	04	SPECIFICATION AUTHENTICATION	SP
0	15	01	19	ADD TO SPECIFICATIONS	PMD

DATE: 15/01/19
SCALE: NTS
DRAWN: PMD
APPROVED:

Medicine Hat
The Gas City

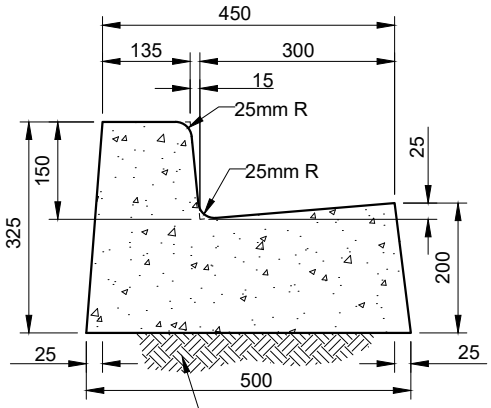
W-BEAM GUARDRAIL HARDWARE
WOOD SPACER BLOCK & POST
STRONG POST SYSTEM

DWG. No. RD 207 Rev. 1



GRANULAR MATERIAL UNLESS OTHERWISE IDENTIFIED IN SPECS.COMPACT SUBGRADE TO A MINIMUM OF 100% STANDARD PROCTOR MAXIMUM DRY DENSITY@ ± 2.0% of OPTIMUM MOISTURE CONTENT

ROLLED CURB & 250mm GUTTER



GRANULAR MATERIAL UNLESS OTHERWISE IDENTIFIED IN SPECS.COMPACT SUBGRADE TO A MINIMUM OF 100% STANDARD PROCTOR MAXIMUM DRY DENSITY@ ± 2.0% of OPTIMUM MOISTURE CONTENT

150mm STANDARD CURB & 300mm GUTTER

NOTES:
1. CONCRETE TO COMPLY WITH MW SPECIFICATIONS
2. ALL DIMENSIONS ARE IN MILLIMETRES

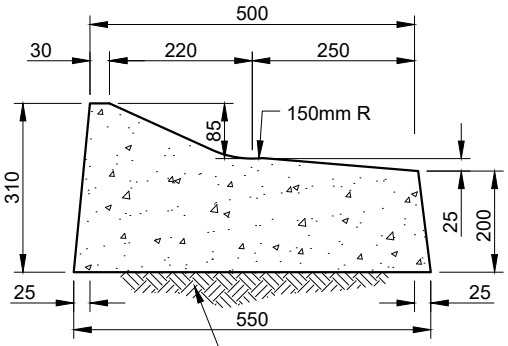
No.	DATE YY	MM	DD	REVISION DESCRIPTION	BY
2	23	04	04	SPECIFICATION AUTHENTICATION	SP
1	15	01	19	TITLEBLOCK/FONT/DWG NUMBER	PMD
0	09	03	18	FOR APPROVAL	PNB

DATE: 01/09/06
SCALE: NTS
DRAWN: C.B.
APPROVED:

Medicine Hat
The Gas City

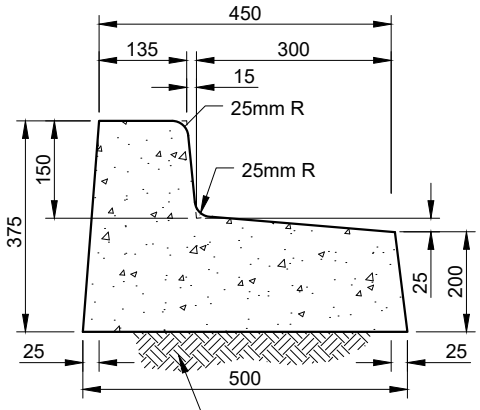
CURB & GUTTER SECTIONS

DWG. No. RD 300 Rev. 2



GRANULAR MATERIAL COMPACT SUBGRADE TO A
MINIMUM OF 100% STANDARD PROCTOR MAXIMUM
DRY DENSITY@ ± 2.0% of OPTIMUM MOISTURE CONTENT

ROLLED CURB & 250mm GUTTER



GRANULAR MATERIAL COMPACT SUBGRADE TO A
MINIMUM OF 100% STANDARD PROCTOR MAXIMUM
DRY DENSITY@ ± 2.0% of OPTIMUM MOISTURE CONTENT

150mm STANDARD CURB & 300mm GUTTER

NOTES:

1. CONCRETE TO COMPLY WITH MW SPECIFICATIONS
2. ALL DIMENSIONS ARE IN MILLIMETRES

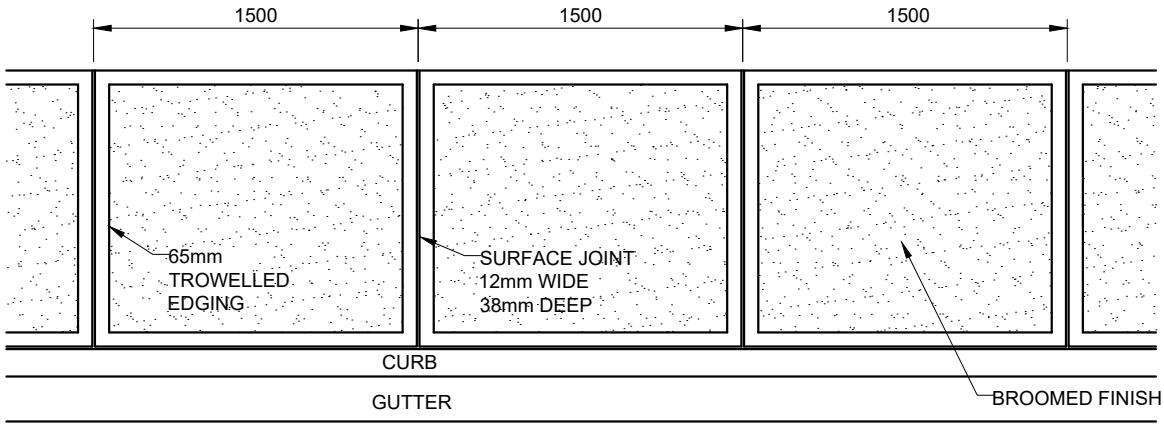
No.	YY	MM	DD	REVISION DESCRIPTION	BY
2	23	04	04	SPECIFICATION AUTHENTICATION	SP
1	15	01	20	TITLEBLOCK/FONT/DWG NUMBER	PMD
0	09	03	18	FOR APPROVAL	PNB

DATE: 01/09/06
SCALE: NTS
DRAWN: C.B.
APPROVED:

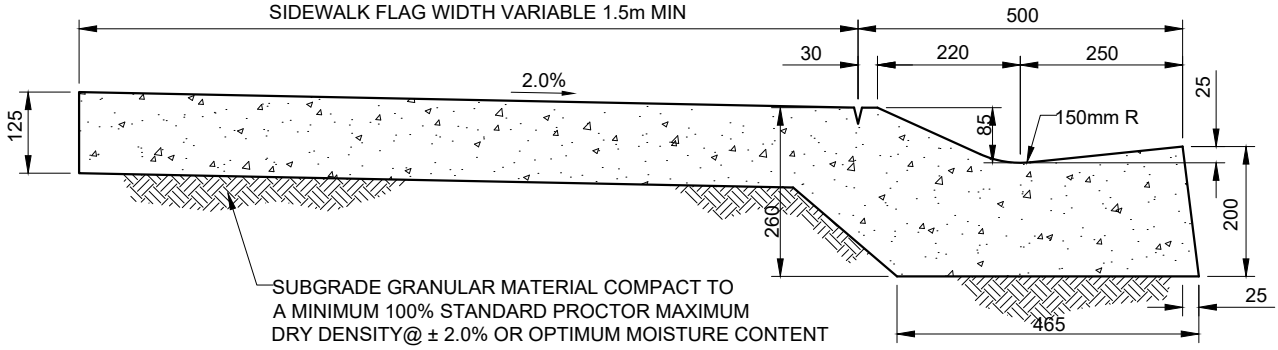
Medicine Hat
The Gas City

CURB & DROPPED
GUTTER SECTIONS

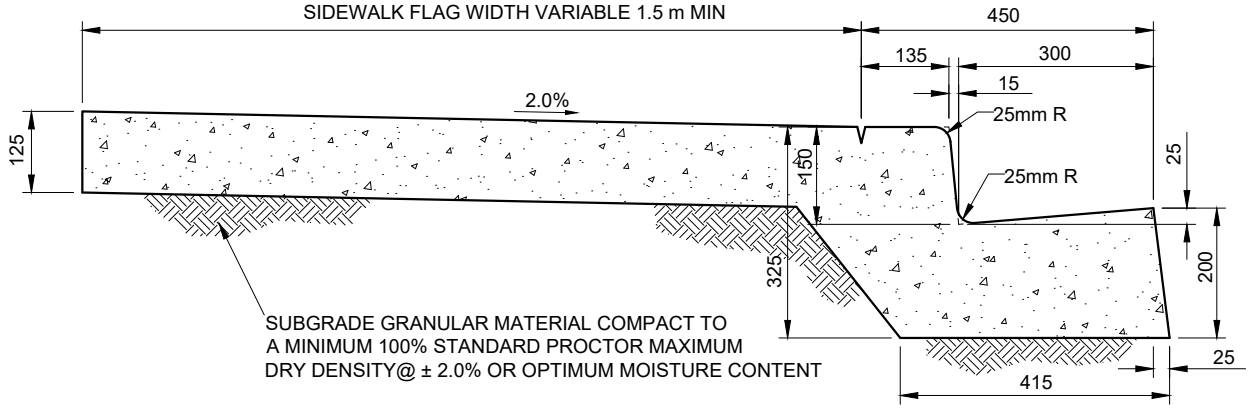
DWG. No. RD 301 Rev. 2



PLAN VIEW



ROLLED CURB SECTION



STANDARD CURB SECTION

NOTES:

1. CONCRETE TO COMPLY WITH MW SPECIFICATIONS
2. ALL DIMENSIONS ARE IN MILLIMETRES

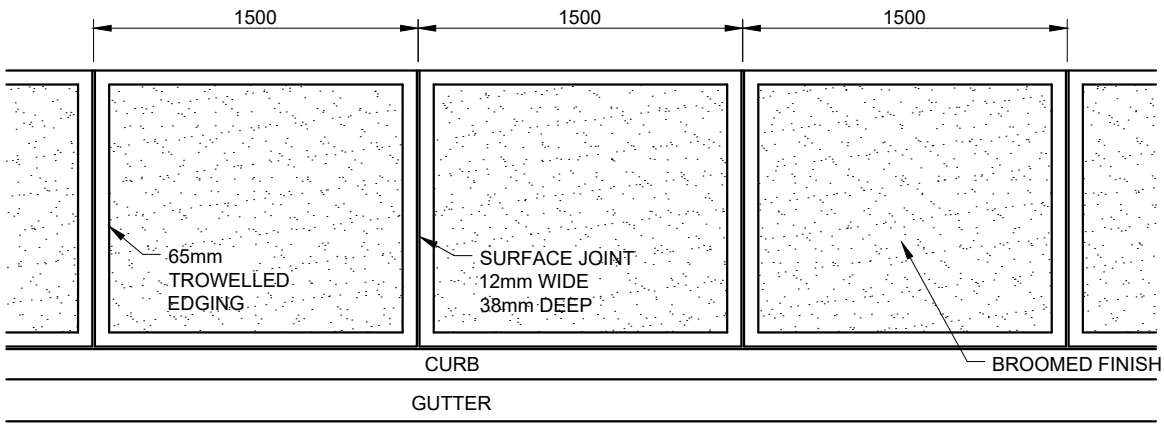
No.	YY	MM	DD	REVISION DESCRIPTION	BY
2	23	04	04	SPECIFICATION AUTHENTICATION	SP
1	15	01	19	DRAWING NUMBER CHANGE	PMD
0	09	03	18	FOR APPROVAL	PNB

DATE: 01/09/06
SCALE: NTS
DRAWN: C.B.
APPROVED:

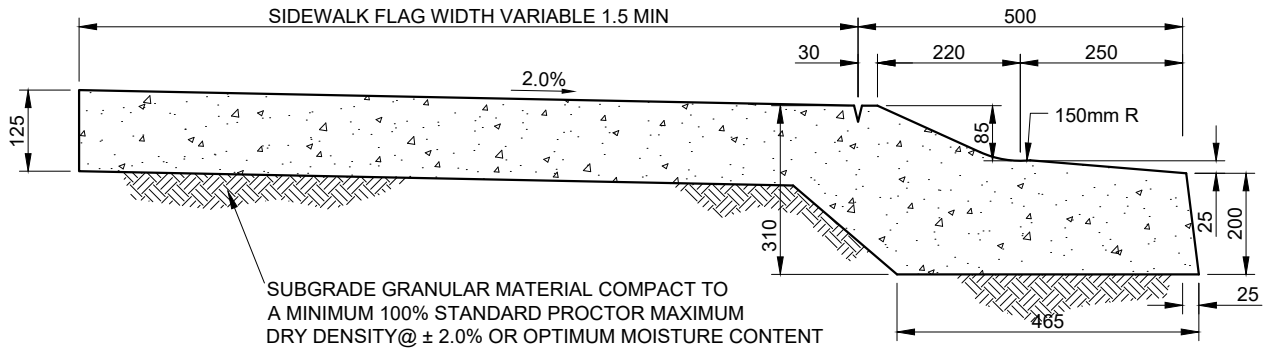
Medicine Hat
The Gas City

MONOLITHIC SIDEWALK
CURB & GUTTER

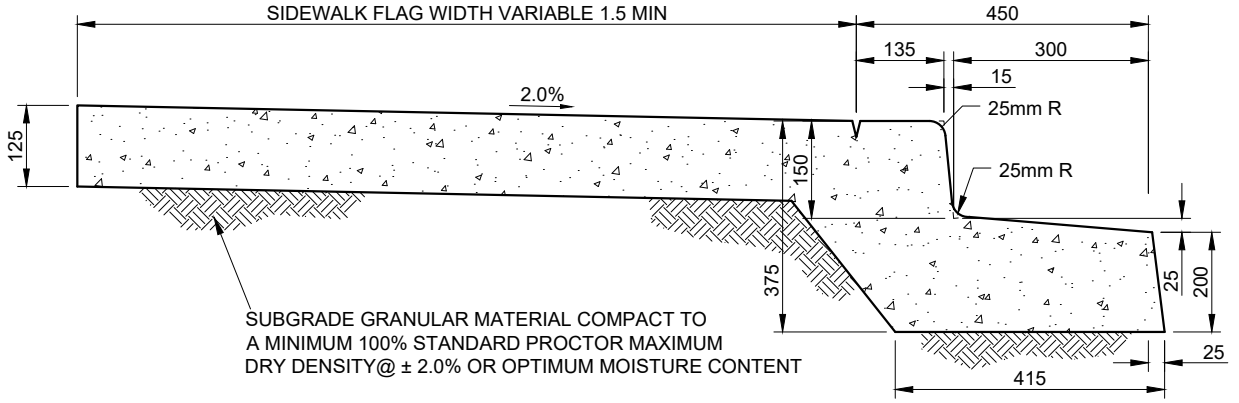
DWG. No. RD 302 Rev. 2



PLAN VIEW



ROLLED CURB SECTION



STANDARD CURB SECTION

NOTES:
1. CONCRETE TO COMPLY WITH MW SPECIFICATIONS
2. ALL DIMENSIONS ARE IN MILLIMETRES

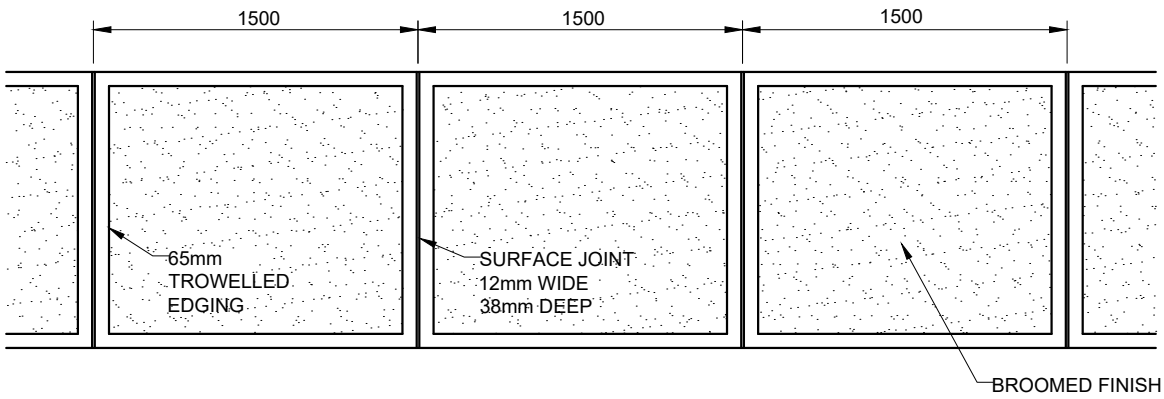
No.	DATE (YY MM DD)	REVISION DESCRIPTION	BY
2	23 04 04	SPECIFICATION AUTHENTICATION	SP
1	15 01 20	TITLEBLOCK/FONT/DWG NUMBER	PMD
0	09 03 18	FOR APPROVAL	PNB

DATE: 01/09/06
SCALE: NTS
DRAWN: C.B.
APPROVED:

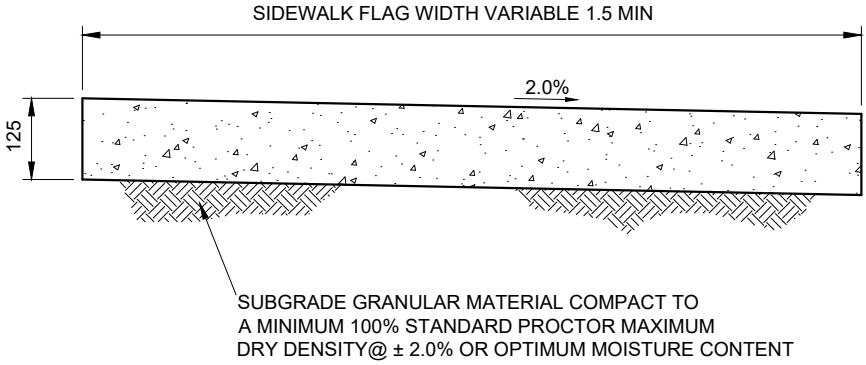
Medicine Hat
The Gas City

MONOLITHIC SIDEWALK, CURB
WITH DROPPED FACE GUTTER

DWG. No. RD 303 Rev. 2



PLAN VIEW



SECTION

NOTES:

1. CONCRETE TO COMPLY WITH MW SPECIFICATIONS
2. ALL DIMENSIONS ARE IN MILLIMETRES
3. GRANULAR MATERIAL UNLESS OTHERWISE SPECIFIED

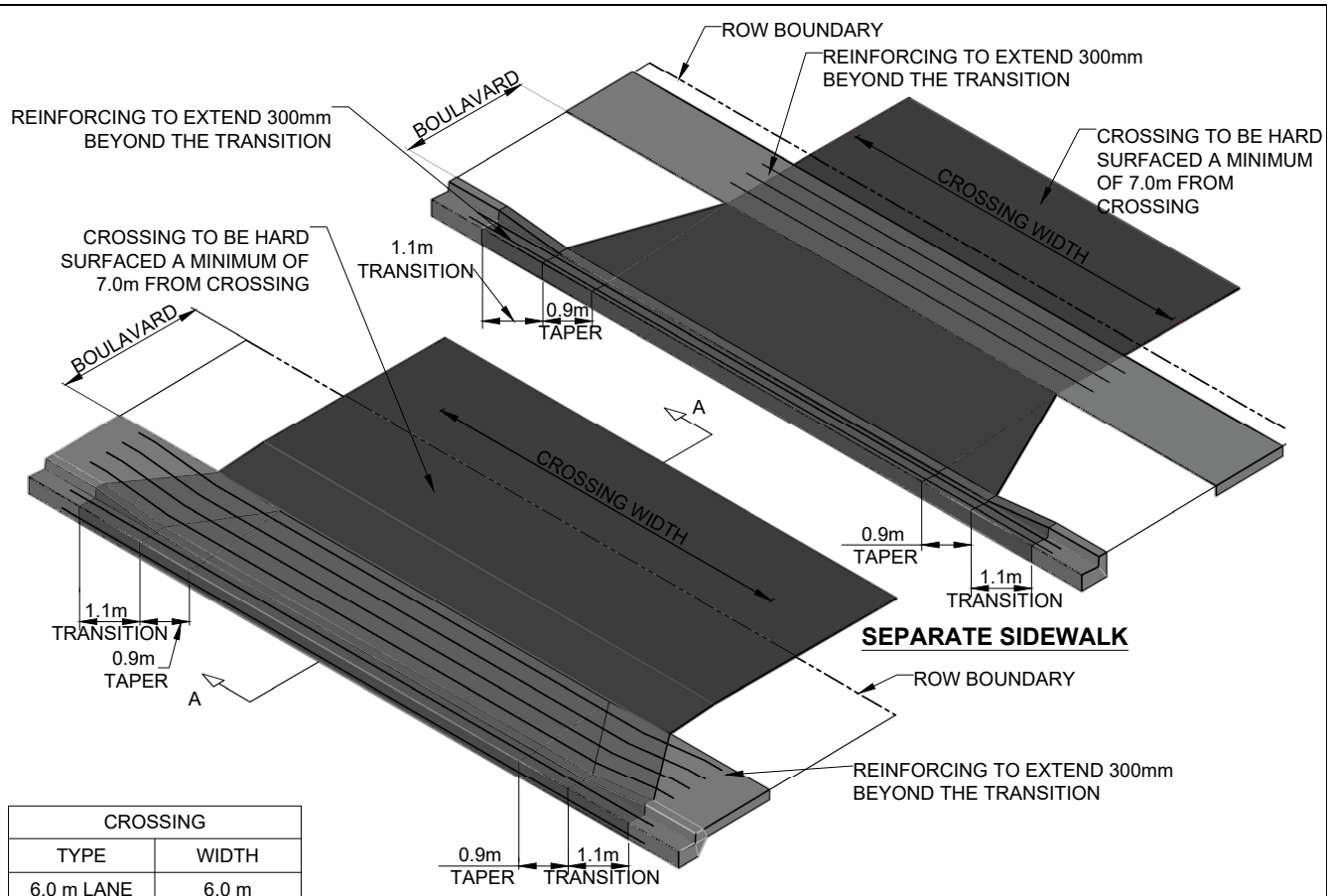
No.	DATE YY	MM	DD	REVISION DESCRIPTION	BY
2	23	04	04	SPECIFICATION AUTHENTICATION	SP
1	15	01	19	TITLEBLOCK/FONT/DWG NUMBER	PMD
0	09	03	18	FOR APPROVAL	PNB

DATE: 01/09/06
SCALE: NTS
DRAWN: C.B.
APPROVED:

Medicine Hat
The Gas City

SEPARATE SIDEWALKS

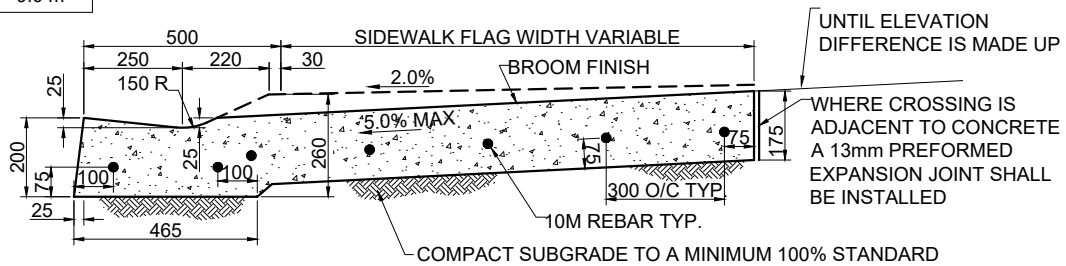
DWG. No. RD 304 Rev. 2



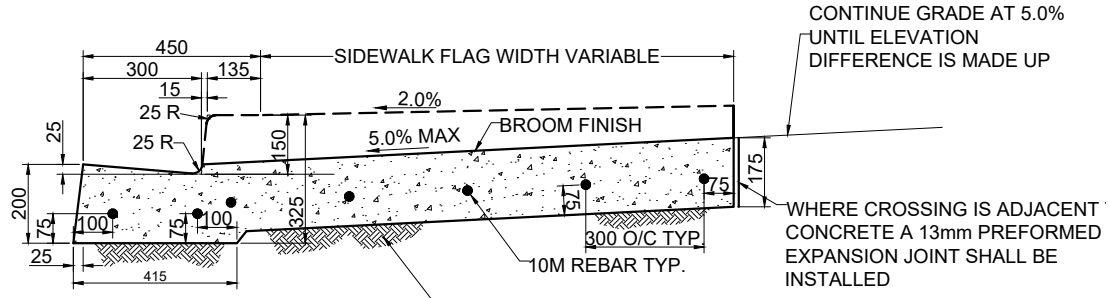
SEPARATE SIDEWALK

MONOWALK

CROSSING	
TYPE	WIDTH
6.0 m LANE	6.0 m
9.0 m LANE	9.0 m
DRIVEWAY	7.5 - 9.0 m



ROLLED SECTION A-A



STANDARD SECTION A-A

NOTES:
1. CONCRETE & REINFORCED STEEL TO COMPLY WITH MW SPECIFICATIONS
2. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SHOWN

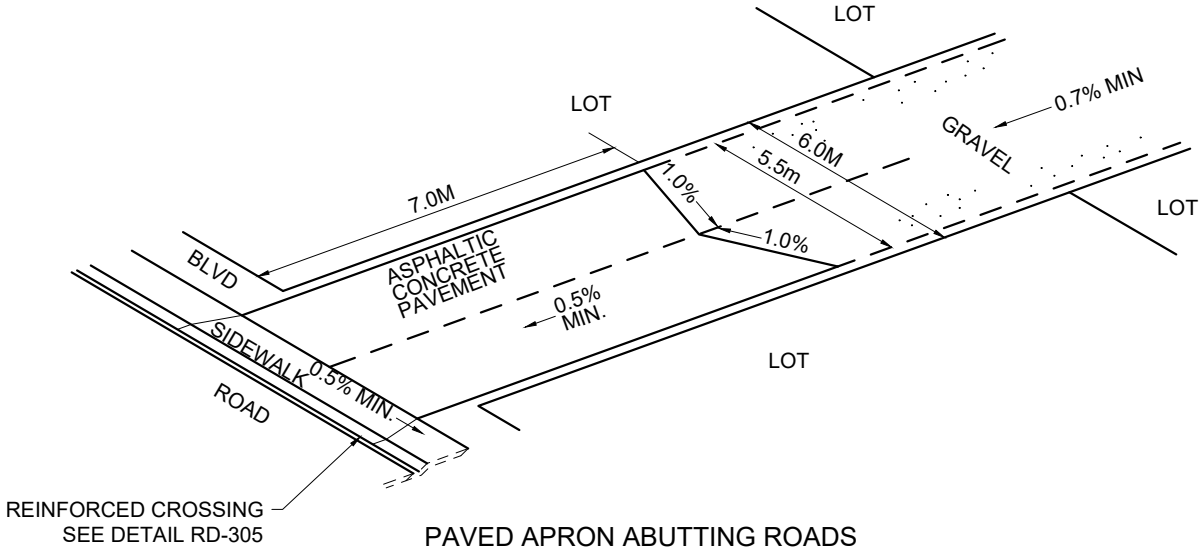
No.	DATE (YY MM DD)	REVISION DESCRIPTION	BY
2	23 04 04	SPECIFICATION AUTHENTICATION	SP
1	15 01 19	TITLEBLOCK/FONT/DWG NUMBER	PMD
0	09 03 18	FOR APPROVAL	PNB

DATE: 01/09/06
SCALE: NTS
DRAWN: C.B.
APPROVED:

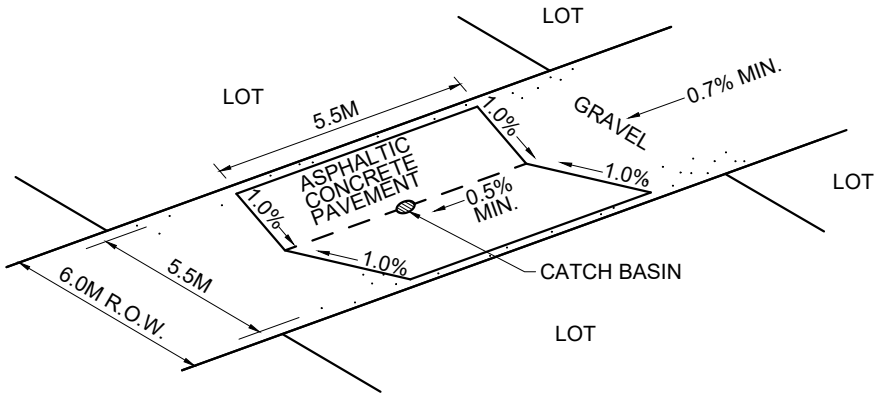
Medicine Hat
The Gas City

LOW VOLUME LAND & DRIVEWAY CROSSINGS

DWG. No. RD 305 Rev. 2



PAVED APRON ABUTTING ROADS



PAVED APRON AT CATCH BASINS IN LANE

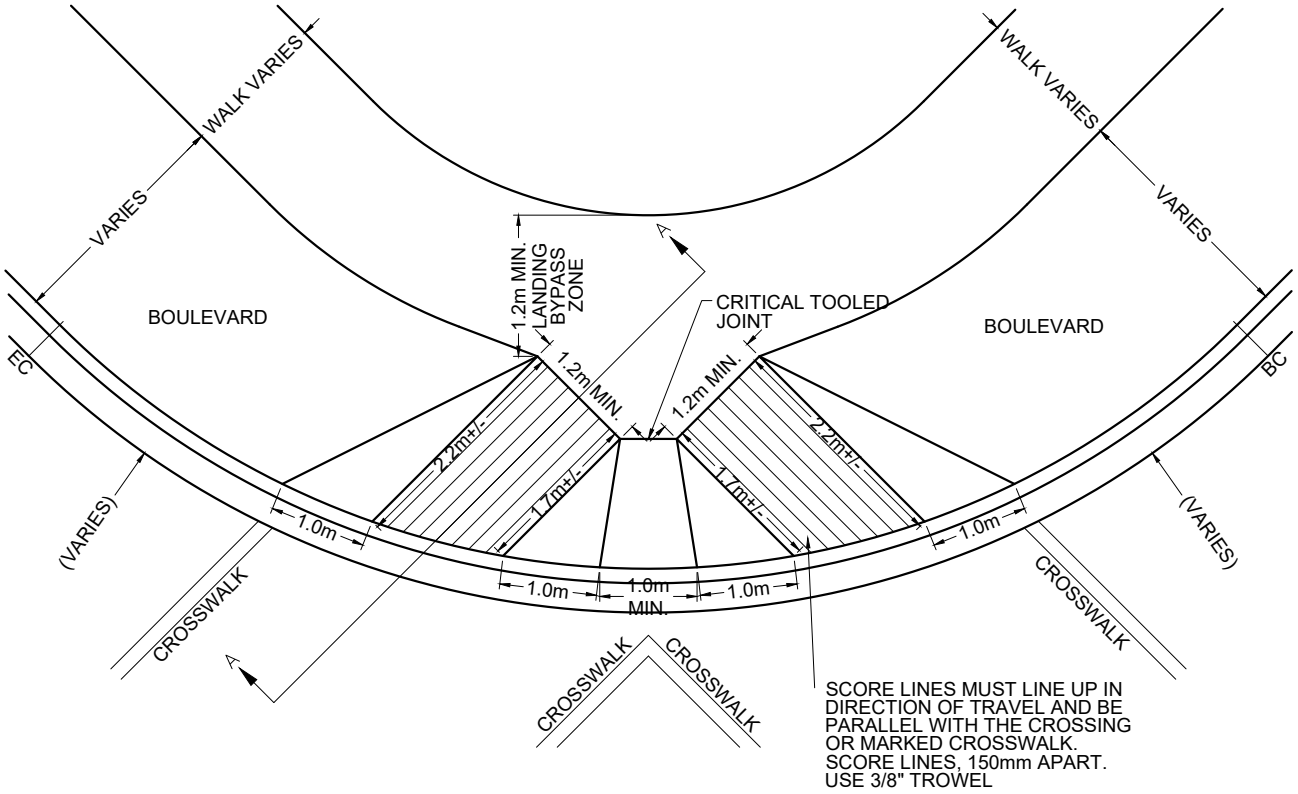
No.	YY	MM	DD	REVISION DESCRIPTION	BY
1	23	04	04	SPECIFICATION AUTHENTICATION	SP
0	15	05	14	RECREATED FOR 2015 STD. DRAWINGS	

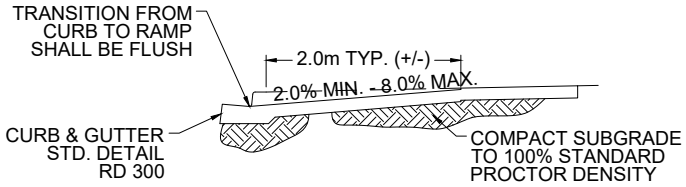
DATE: 05/14/2015
SCALE: NTS
DRAWN: J.M.
APPROVED:

Medicine Hat
The Gas City

PAVED APRONS FOR GRAVEL LANES

DWG. No. RD 306 Rev. 0





SECTION A-A CURB RAMP

NOTES:

1. RAMPS FOR USERS OF WHEEL CHAIRS & BICYCLES SHOULD BE LOCATED AT ALL JUNCTIONS OF CROSSWALKS AND SIDEWALKS. RAMPS MUST BE LOCATED WITHIN A CROSSWALK
2. GROOVES ON SIDEWALK RAMPS ARE TO ALERT PERSONS, WHO ARE VISUALLY IMPARIED, OF THE CURB-CUT AND STREET CROSSING
3. WHERE CROSSWALKS ARE CONTROLLED BY SIGNALS PUSH BUTTON SYSTEM, THE SIDEWALKS AND RAMPS MUST ALLOW ACCESS BY WHEEL-CHAIR TO THE PUSH BUTTON
4. CONCRETE SIDEWALKS, CURBS AND RAMPS TO BE POURED MONOLITHICALLY
5. CONCRETE TO COMPLY WITH MW SPECIFICATIONS
6. STANDARD RAMP LENGTH 2.0m
7. RECOMMENDED RAMP SLOPE 2.0% MIN - 8.0% MAX
8. ADJUST LENGTH OF RAMP AS REQUIRED, WHEN SITE CONDITIONS DO NOT PERMIT TYPICAL LAYOUT, CONTACT MW DEPARTMENT FOR APPROVAL OF DESIGN.
9. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE NOTED

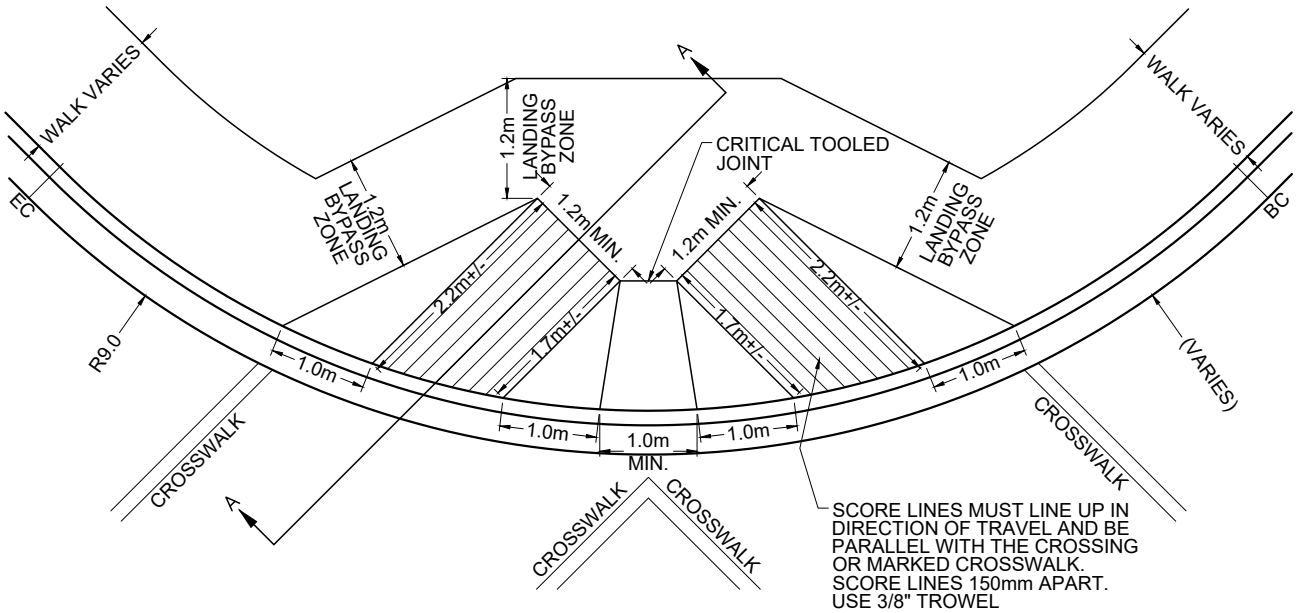
No.	DATE (YY MM DD)	REVISION DESCRIPTION	BY
2	23 04 04	SPECIFICATION AUTHENTICATION	SP
1	15 01 19	TITLEBLOCK/FONT/DWG NUMBER	PMD
0	12 12 18	FOR APPROVAL	DB

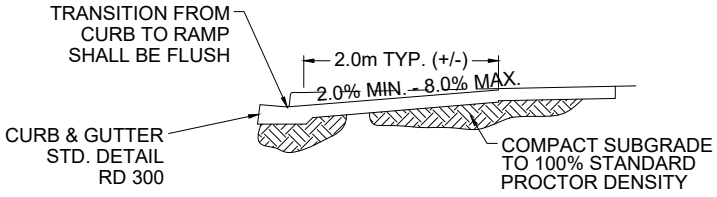
DATE: 12/12/18
SCALE: NTS
DRAWN: E.A.
APPROVED:

Medicine Hat
The Gas City

DOUBLE CURB RAMP DESIGN SEPARATE SIDEWALK

DWG. No. RD 307 Rev. 2





SECTION A-A CURB RAMP

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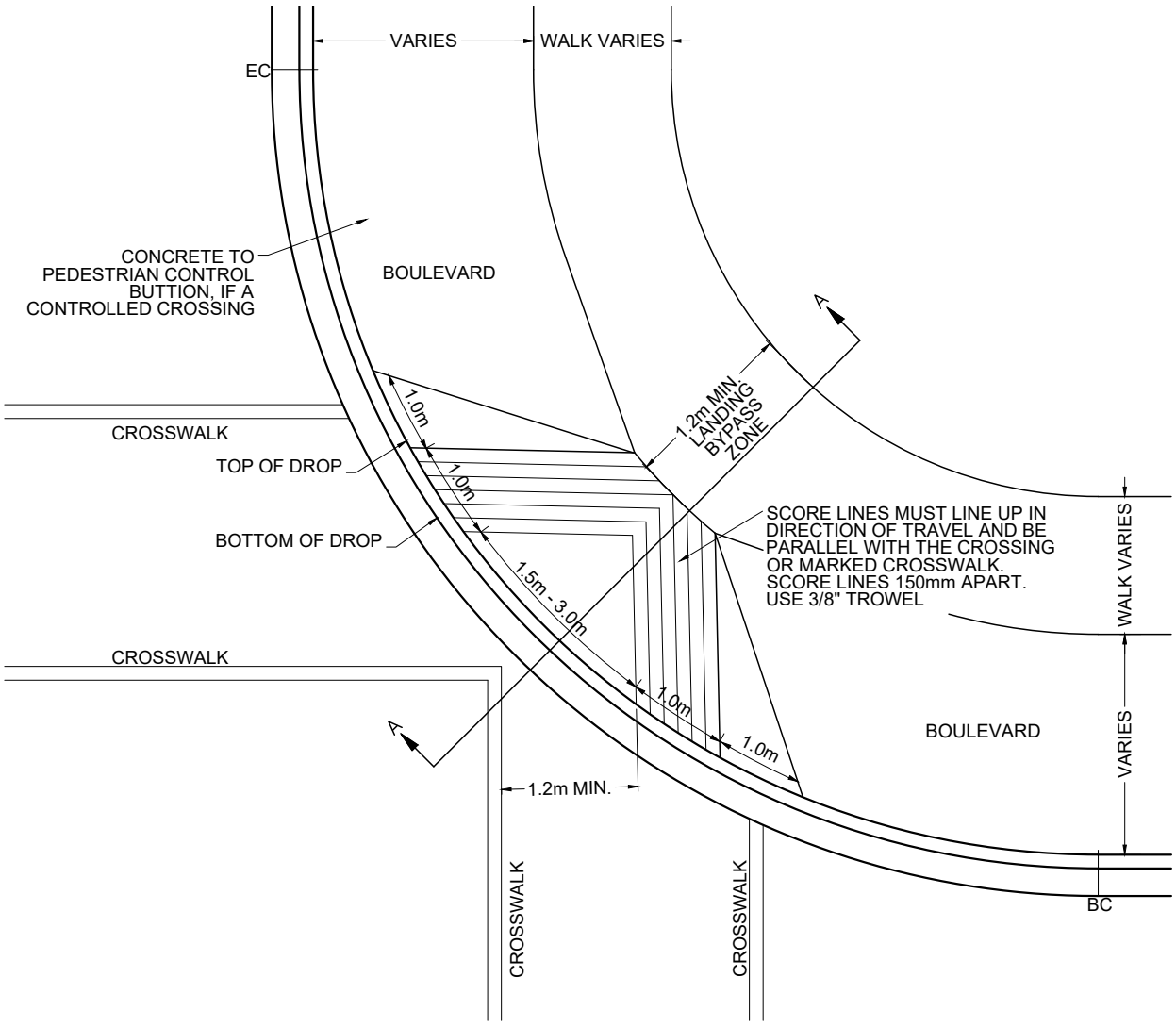
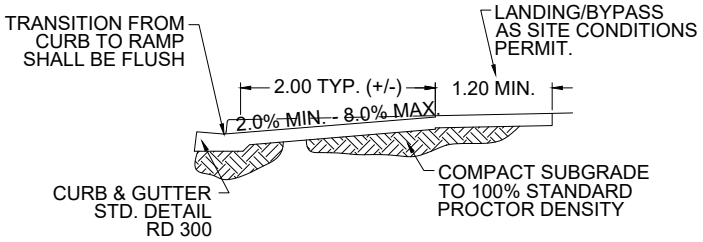
DATE: 12/12/18
SCALE: NTS
DRAWN: E.A.
APPROVED:

Medicine Hat
The Gas City

DOUBLE CURB
RAMP DESIGN
MONOWALK

DWG. No. RD 308 Rev. 2





SECTION A-A CURB RAMP

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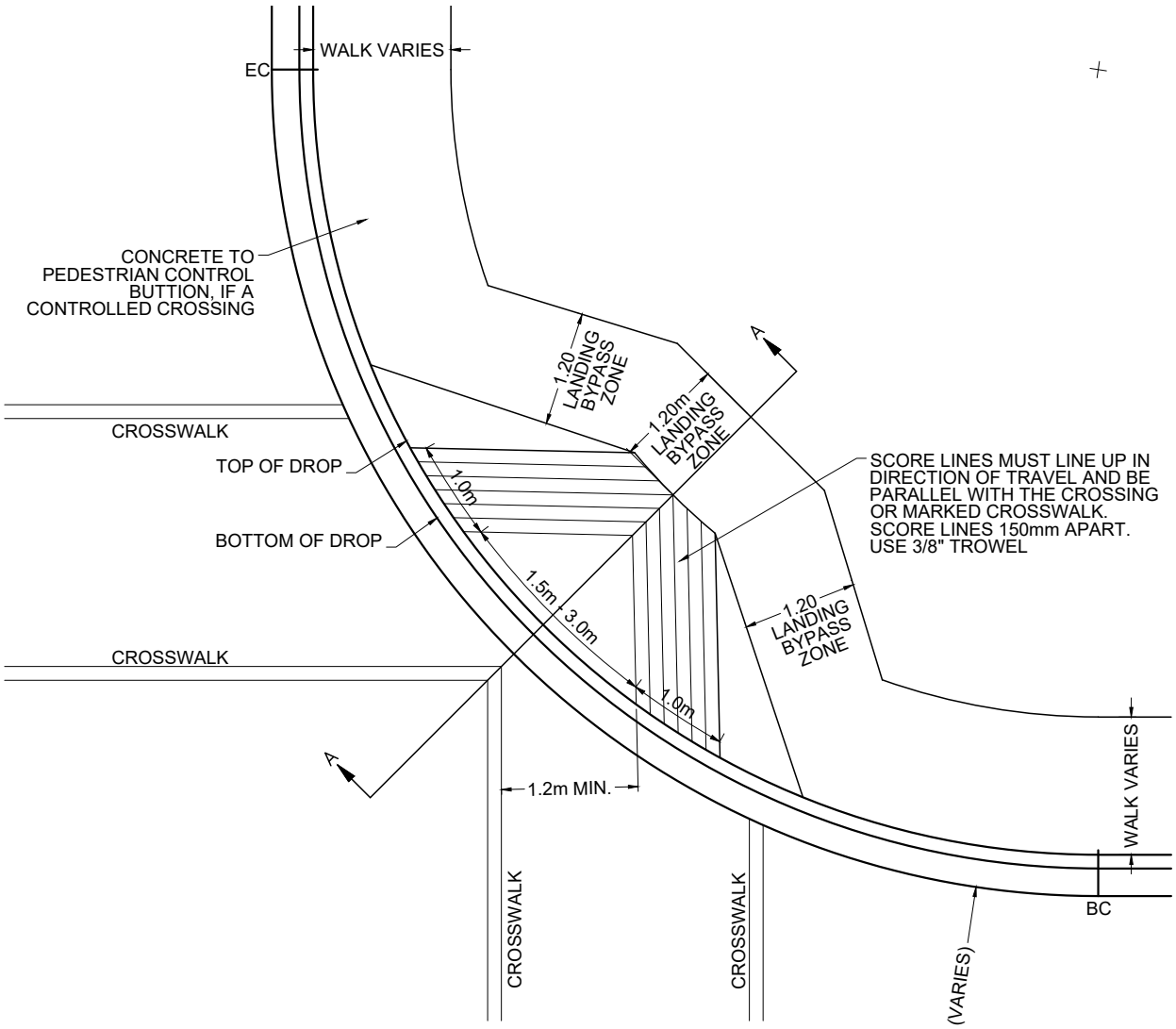
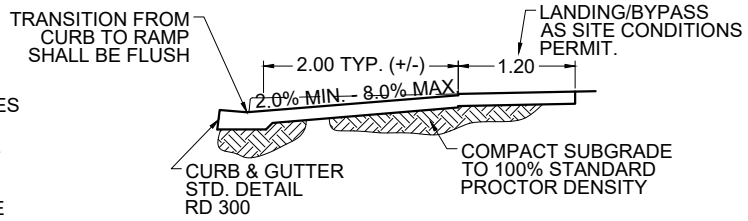
DATE: 12/12/18
SCALE: NTS
DRAWN: E.A.
APPROVED:

Medicine Hat
The Gas City

LARGE SINGLE CURB RAMP DESIGN SEPARATE SIDEWALK

DWG. No. RD 309 Rev. 2





SECTION A-A CURB RAMP

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4. CONCRETE SIDEWALKS, CURBS AND RAMPS TO BE POURED MONOLITHICALLY
5. MINIMUM WIDTH OF RAMP IS 1.5m. IT MAY BE NECESSARY TO BUILD WIDER RAMPS IN BUSY URBAN AREAS WHERET HE VOULUME OF PEDESRIAN TRAFFIC IS HIGH
6. CONCRETE TO COMPLY WITH MW SPECIFICATIONS
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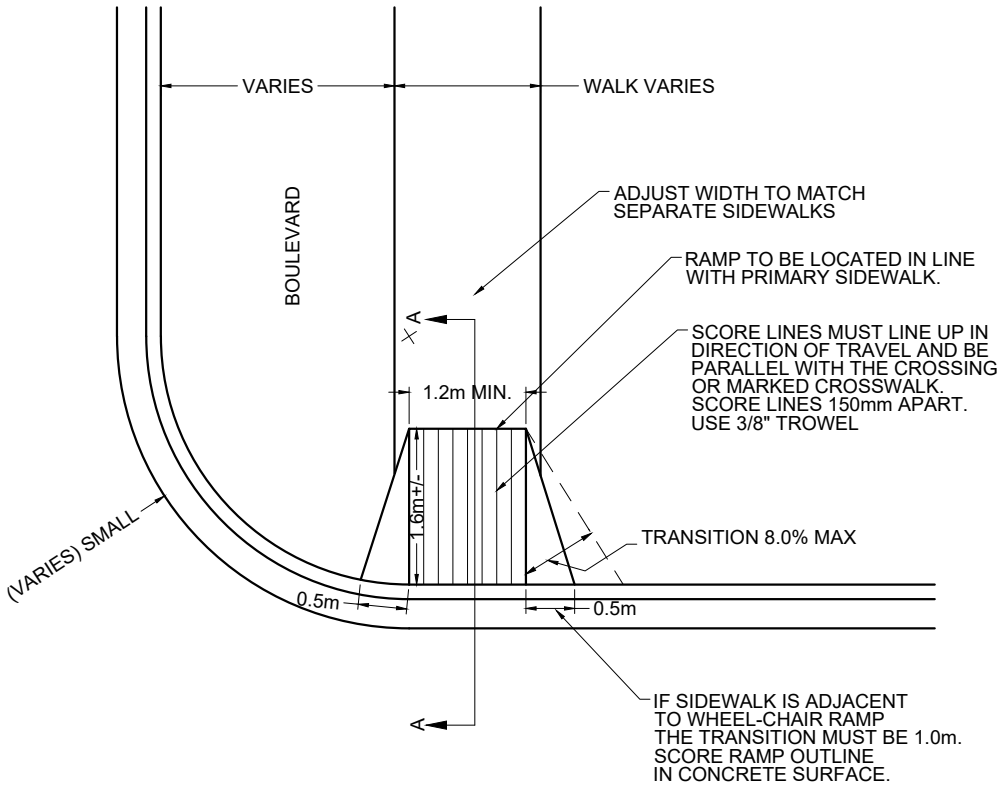
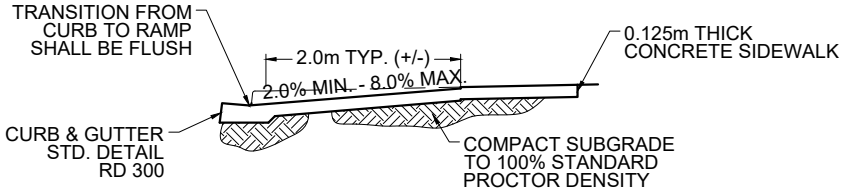
SCALE: NTS
DRAWN: E.A.
APPROVED:

Medicine Hat
The Gas City

LARGE SINGLE CURB RAMP DESIGN MONOWALK

DWG. No. RD 310 Rev. 2





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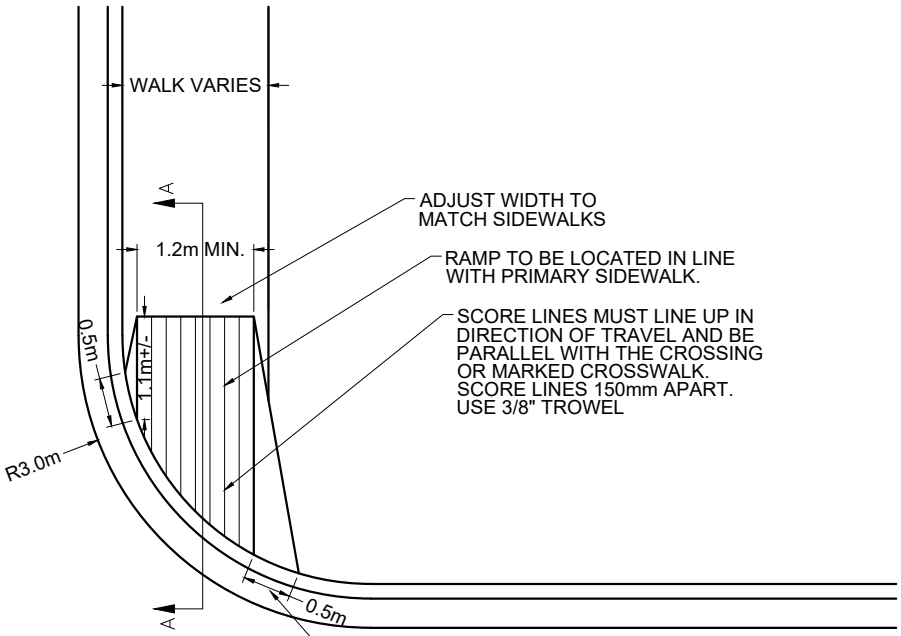
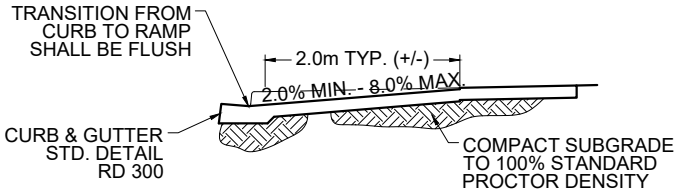
DATE: 12/12/18
SCALE: NTS
DRAWN: E.A.
APPROVED:

Medicine Hat
The Gas City

ONE DIRECTION CURB RAMP DESIGN SEPARATE SIDEWALK

DWG. No. RD 311 Rev. 2





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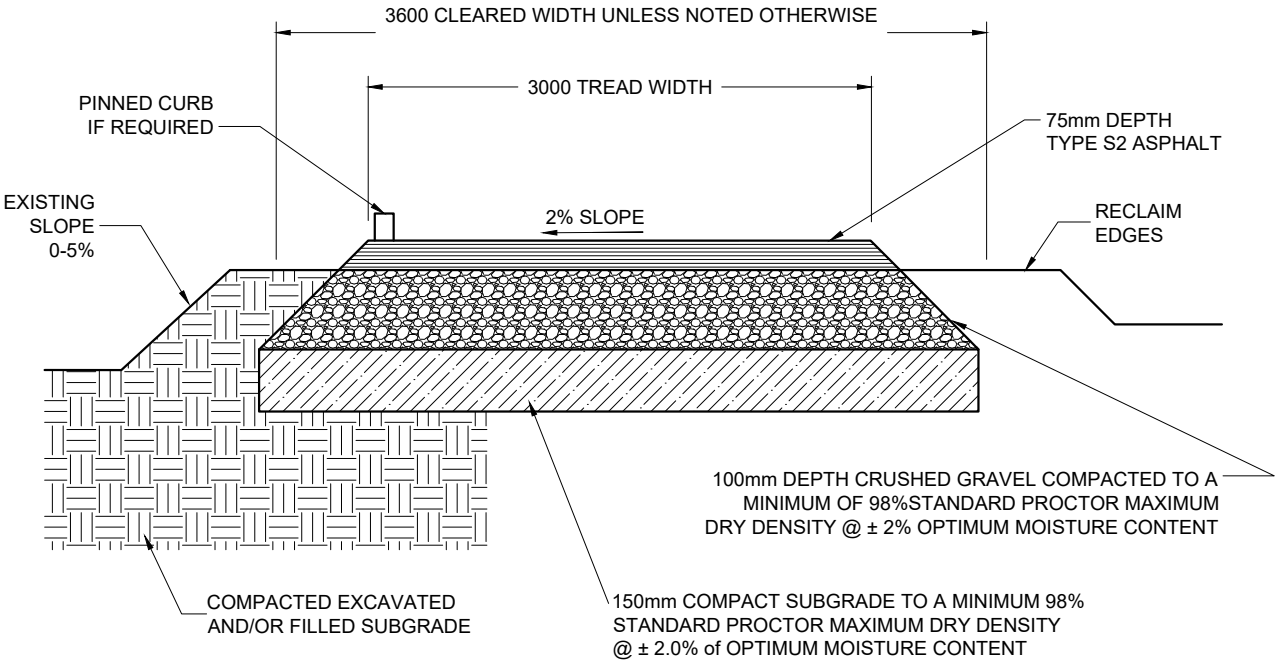
DATE: 12/12/18
SCALE: NTS
DRAWN: E.A.
APPROVED:

Medicine Hat
The Gas City

ONE DIRECTION CURB RAMP DESIGN MONOSIDEWALK

DWG. No. RD 312 Rev. 2



TYPICAL FLAT SECTION

0-5% EXISTING SLOPE

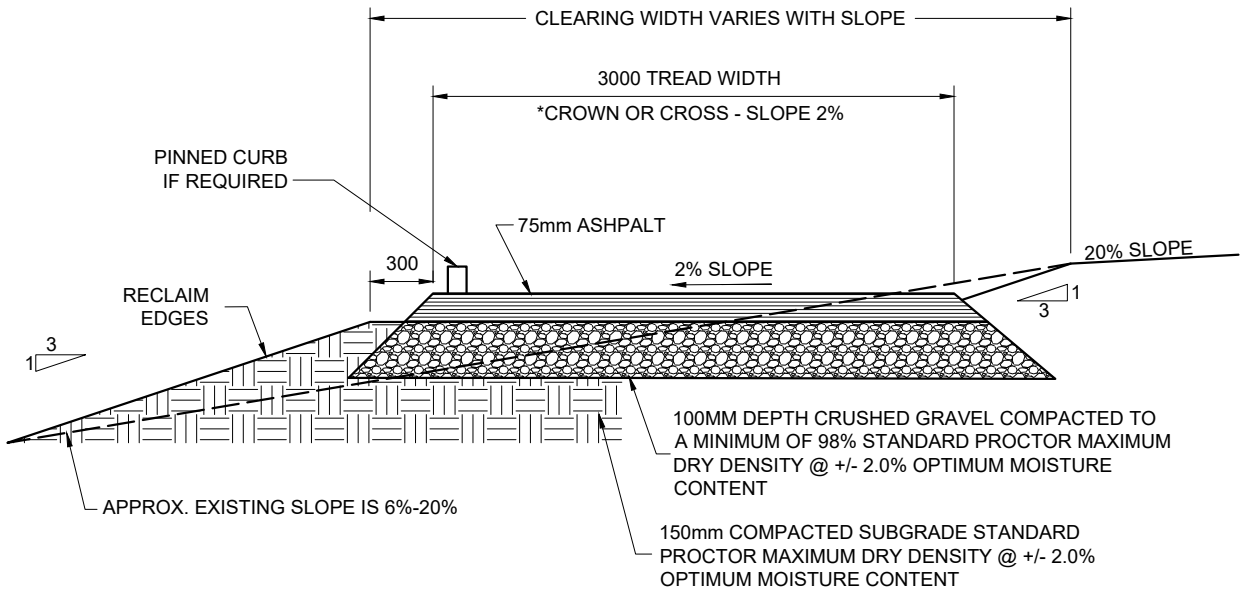
No.	YY	MM	DD	REVISION DESCRIPTION	BY
2	23	04	04	SPECIFICATION AUTHENTICATION	SP
1	15	01	20	TITLEBLOCK/FONT/DWG NUMBER	PMD
0	09	03	18	FOR APPROVAL	PNB

DATE: 01/09/06
SCALE: NTS
DRAWN: C.B.
APPROVED:

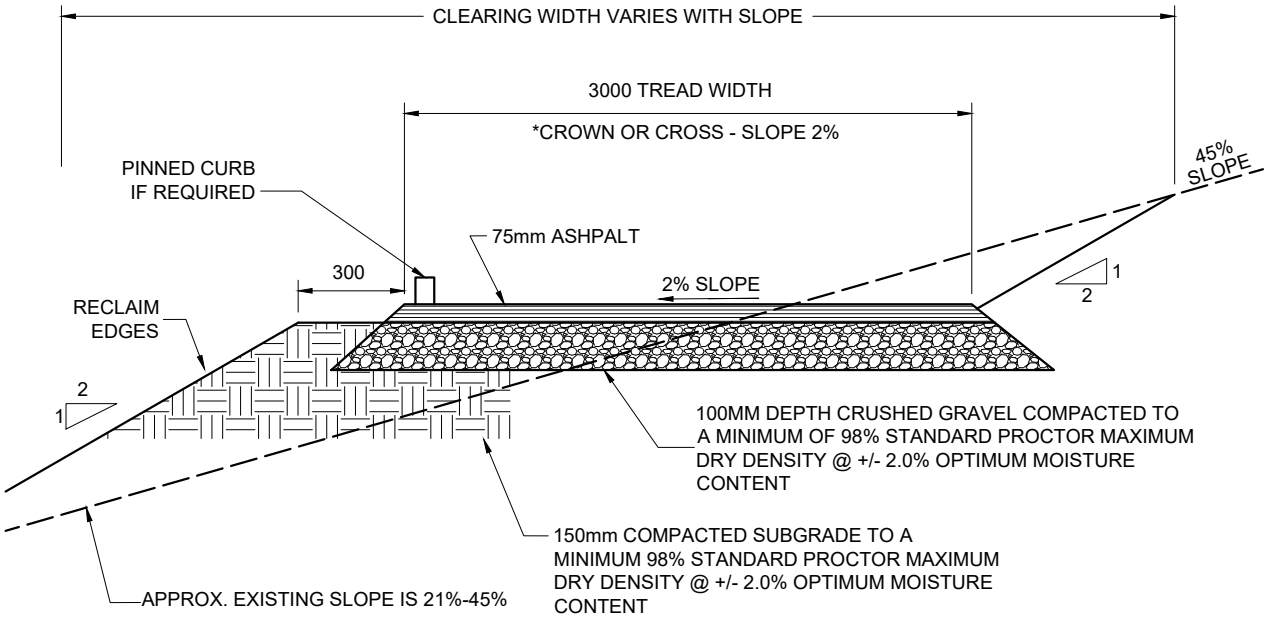
Medicine Hat
The Gas City

MULTI – USE
SIDEWALK

DWG. No. RD 313 Rev. 2



TYPICAL SLIGHT SIDEHILL SECTION
CUT AND FILL 6-20% EXISTING SLOPE



TYPICAL SLIGHT SIDEHILL SECTION
CUT AND FILL 21-45% EXISTING SLOPE

NOTE:
SOIL MATTING, RETAINING WALLS.
MAY BE REQUIRED SEE DRAWINGS

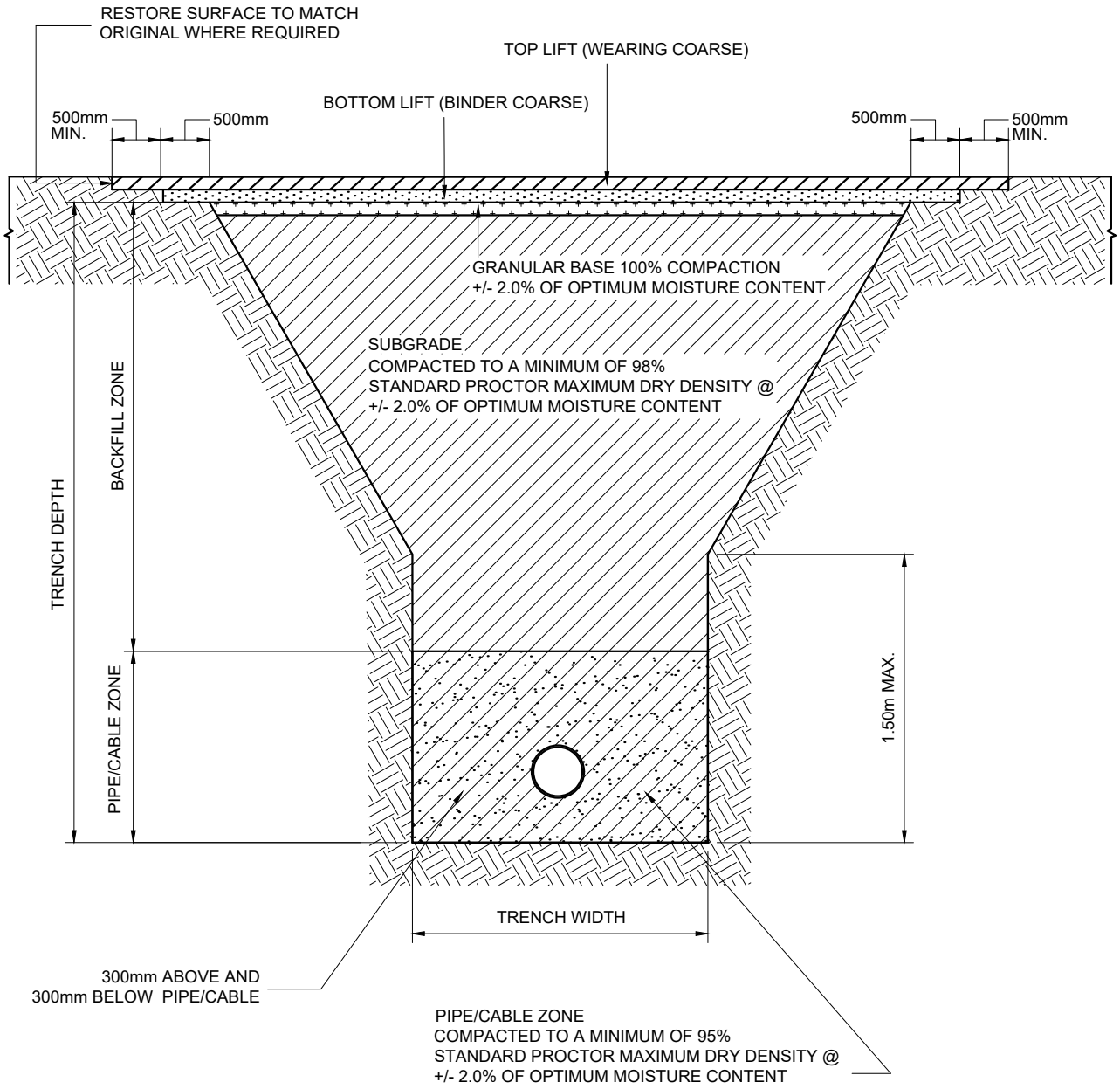
No.	YY	MM	DD	REVISION DESCRIPTION	BY
2	23	04	04	SPECIFICATION AUTHENTICATION	SP
1	15	01	20	TITLEBLOCK/FONT/DWG NUMBER	PMD
0	09	03	18	FOR APPROVAL	PNB

DATE: 01/09/06
SCALE: NTS
DRAWN: C.B.
APPROVED:

Medicine Hat
The Gas City

MULTI-USE SIDEWALK
WITH SIDE AND
BACK SLOPE

DWG. No. RD 314 Rev. 2



NOTE:
THE EXTENT AND NATURE OF PAVEMENT/SURFACE RESTORATION SHALL BE AS PER THE DIRECTION OF MUNICIPAL WORK DEPARTMENT

No.	DATE YY	MM	DD	REVISION DESCRIPTION	BY
2	23	04	04	SPECIFICATION AUTHENTICATION	SP
1	15	01	20	TITLEBLOCK/FONT/DWG NUMBER	PMD
0	09	02	24	FOR APPROVAL	PNB

DATE: 03/23/06
SCALE: NTS
DRAWN: C.B.
APPROVED:

Medicine Hat
The Gas City

UTILITY TRENCH BACKFILL REQUIREMENTS

DWG. No. RD 315 Rev. 2