APPENDIX Q – CITY OF WINNIPEG STANDARD SPECIFICATIONS

CW 1110 - GENERAL INSTRUCTIONS

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CW 1110 - GENERAL INSTRUCTIONS

1. DESCRIPTION

1.1 General

.1 This specification provides general instructions, definitions of terms used in the Standard Construction Specifications, quality control measures for materials supplied, equipment used and submittals and shop drawings required for performing Underground and Surface Works.

1.2 Definitions

.1 Capitalized wording that appears in the City of Winnipeg Standard Construction Specifications is applicable to the definitions contained in Clause GC:1 of the General Conditions for Construction Contracts.

1.3 Quality Control

.1 Testing and Approval of Materials

.1 Materials supplied for Underground and Surface Work are subject to inspection, testing and approval by the Contract Administrator or the Testing Laboratory designated by the Contract Administrator.

.2 Provide materials required for testing to the Contract Administrator or testing laboratory at no cost unless otherwise indicated in the Specifications.

.3 Perform the Work to the quality control requirements in accordance with the Specifications.

1.4 Equipment

.1 Use equipment, implements, tools and facilities suitable for work being performed and satisfactory to the Contract Administrator. Provide specialized equipment where required in accordance with the Specifications.

1.5 Submittals and Shop Drawings

.1 Submittals

.1 Provide submittals in accordance with the Specifications or as required by the Contract Administrator.

.2 Shop Drawings

.1 Prepare Shop Drawings in accordance with the Specifications or as required by the Contract Administrator.

.2 Review, sign and date all Shop Drawings before submitting to the Contract Administrator. Verify field measurements, field construction criteria, materials, catalogue numbers and similar data and check and coordinate each Shop Drawing with requirements of the Work.

.3 Have Shop Drawings stamped, signed and dated by a Professional Engineer licensed to practice in the Province of Manitoba where required in the Specifications or by the Contract Administrator.

.4 Submit Shop Drawings promptly to the Contract Administrator in an orderly sequence to prevent delay in the Work or in the work of other Contractors. Notify the Contract Administrator at the time of submission of any deviations in the Shop Drawings from the requirements of the Specifications.

.5 The Contract Administrator will review Shop Drawings promptly or in accordance with a schedule agreed upon in writing. Upon completion of review the Contract Administrator will communicate either acceptance or rejection of Shop Drawings. The Contract Administrator's review and acceptance will be for conformity to design concept of the Work and for compliance with the Specifications.

.6 Acceptance of Shop Drawings for a component or a subassembly does not constitute acceptance of the complete assembly of which it is a part.

.7 The Contract Administrator's review will not relieve responsibility for errors and omissions in Shop Drawings or of the responsibility for meeting requirements of the Specifications unless identified deviations on Shop Drawings have been approved by the Contract Administrator.

.8 Make changes to Shop Drawings as required by the Contract Administrator that are consistent with the Specifications and promptly resubmit Shop Drawings to the Contract Administrator for review and acceptance unless otherwise indicated by the Contract Administrator. Notify the Contract Administrator of any revisions other than those requested by the Contract Administrator when resubmitting Shop Drawings.

.9 Do not undertake work associated with Shop Drawings until the Contract Administrator's review is completed and Shop Drawings are accepted.

.10 Shop Drawings are to be in accordance with the following requirements.

.1 Sheet size: appropriate for item and information being depicted.

.2 Submit 5 prints or an electronic file in a format acceptable to the Contract Administrator.

.3 Show the following information in lower right hand corner.

.1 Project Title.

.2 Tender number or other project number assigned by the Contract Administrator.

.3 Name of the depicted item in accordance with the Specifications and Drawings.

.4 Project series number and location where the item is used if applicable.

.5 Specification section number if applicable

.6 Proposed option if applicable.

.7 Name of Contractor.

.4 Revise the drawing date for each resubmission.

4. MEASUREMENT AND PAYMENT

4.1 Quality Control, Submittals and Shop Drawings

.1 Quality Control requirements, Submittals and Shop Drawings will not be measured for payment and will be included with Underground or Surface Works unless indicated otherwise in the Specifications.

CW 1120 - EXISTING SERVICES, UTILITIES AND STRUCTURES

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CW 1120 - EXISTING SERVICES, UTILITIES AND STRUCTURES

1. DESCRIPTION

1.1 General

.1 This specification covers requirements and activities for notifying, locating and working around existing services, utilities and structures within and adjacent to the Site, operation and shutdown of the existing waterworks system and provision of temporary water supply during construction of the Works.

1.2 Standard Construction Specification References

.1 CW 2110 - Watermains
.2 CW 2140 – Sewer and Manhole Cleaning

1.3 Standard Detail Drawing References

.1 SD-019 – Backflow Protection Arrangement for Water Supply From Hydrant

3. CONSTRUCTION METHODS

3.1 Notify Utilities and Other Authorities

.1 Make timely application to authorities for required permits before starting work on a public right-of-way.

.2 Obtain utility clearances for underground plant in the vicinity of the Work before starting construction.

.3 Arrange with utilities to provide Safety Watch where required during construction.

.4 Provide required notice to railroad companies affected before starting work within a railway right-of-way.

.5 Provide not less than 48 hours notice to the Contract Administrator concerning:

.1 Watermains temporarily placed out of service and duration.

.2 Streets temporarily closed and duration.

.3 Restoring watermains back into service.

.4 Re-opening temporarily closed streets.

.6 Notify the City of Winnipeg, Public Works Department, Customer Services Division at 986-5640 of street or lane closures and re-openings on Regional Streets except for construction contracts with the City of Winnipeg where the Contract Administrator will notify Customer Services.

3.2 Colour Coding for Temporary Markers for Underground Utilities

.1 The City of Winnipeg has adopted the colour coding system shown in Table CW 1120.1 for marking utility locations in public right-of-ways.

TABLE CW 1120.1 - Colours for Temporary Markers for Underground Utilities

UTILITY OR SYSTEM TYPE	COLOUR
Electric Power Lines, Signal Lines, Cables, Conduit and Lighting Cables	Red
Gas, Oil, Steam, Petroleum or Gaseous Materials	Yellow
Communication, Alarm Lines, Cables or Conduit	Orange
Potable water, Water Irrigation and Slurry Lines	Blue
Sewer and Drain Lines and Tree Planting Spots	Green
Temporary Survey and Street Condition Rating	White
Proposed Construction Survey and Survey Infrastructure Identification	Purple

3.3 Location of Existing Services, Utilities and Structures

.1 Accept the information shown on the Drawings for existing services, utilities and structures at own risk. City assumes no responsibility for accuracy or completeness of information provided.

.2 Verify location of existing services, utilities and structures within the Site.

.3 Locate existing building sewer and water services, utility manhole drains and curb inlet and catch basin leads within the Site.

3.4 Conflict With Existing Services, Utilities and Structures

.1 The Contract Administrator will make arrangements with the owner and the City will pay the costs for relocation and replacement of existing services, utilities and structures in conflict with the Work and where indicated in the Specifications or shown on the Drawings "to be relocated by others".

.2 Expose, support, protect, relocate or remove and replace as required by and in a manner acceptable to the owner, existing services, utilities and structures that are indicated in the Specifications or shown on the Drawings as being adjacent to the Work.

.3 Make arrangements with the owner for relocation, removal and replacement or support of existing poles that are within 2 metres of the Work.

.4 Make arrangements with owner for relocation of existing services, utilities and structures for own convenience.

.5 Make arrangements with owner to repair existing services, utilities and structures adjacent to the Work that are damaged due to carelessness during construction.

.6 Notify the Contract Administrator of existing services, utilities, structures and obstructions that are not shown on the Drawings or are in different locations than shown on the Drawings and are in conflict with the Work.

.7 The Contract Administrator will determine if the alignment or grade of the Work can be altered or if the existing service, utility, structure or obstruction has to be relocated or removed and

replaced. The City will pay costs for authorized changes in work in accordance with Clause GC:7 of the General Conditions.

.8 Remove abandoned and relocate or remove and replace existing building sewer and water services, utility manhole drains, hydrant drains, catch pit and catch basin leads that occur in excavations for and adjacent to the Work

3.5 Operating Valves and Hydrants on Watermains and Feedermains

.1 Valves and hydrants on existing watermains and feedermains and on new watermains and feedermains connected to the existing system are to be operated by personnel from the Water Services Division of the Water and Waste Department only.

.2 Arrange with Water Services Division for an appointment for valve operation on existing watermains and feedermains at least one day prior to the required valve operation.

3.6 Shutdown or Interruption of Existing Watermains

.1 Notify premises affected of planned watermain shutdowns or interruptions. Provide notice and temporary water supply in accordance with Table CW 1120.2.

.2 Notify premises affected by an unplanned watermain shutdown or interruption within 1 hour after shutdown and give estimated duration of shutdown. Provide temporary water supply in accordance with Table CW 1120.2.

TABLE CW 1120.2 - Planned and Unplanned Watermain Shutdown or Interruption Procedures

Length of Shutdown or Interruption	Advance Notice to Premises	Temporary Water Supply
Less than 1 hour	1 Hour	Not required
From 1 hour to 6 hours	Prior Day	Not required
From 6 Hours to12 hours	Prior Day	Water tank
Greater Than 12 hours	Prior Day	Pressurized water supply line

.3 Plan watermain shutdown or interruption affecting a school to take place outside of normal school hours. Contact school affected to determine normal operating hours.

.4 Provide adequately sized temporary pressurized water supply for industrial, commercial and institutional customers affected by a planned watermain shutdown or interruption where water is a requirement for business to operate regardless of requirements in Table CW 1120.2. Schedule watermain shutdown or interruption to suit hours of business operation if directed by the Contract Administrator.

.5 Install temporary pressurized water supply in accordance with CW 2110.

3.7 Water for Construction Works

.1 Water for construction contracts or work may be taken from the City's water system provided a permit is obtained for hydrant use. A separate permit will be required for each hydrant used.

.2 Obtain permits for hydrant use from the Permits Branch of Customer Services Division of the

Public Works Department, at 1155 Pacific Avenue. Ensure Tender Number is noted on each permit for City contract work. Permit is only valid for use for the construction contract or work it was taken out for.

.3 Water Services Division of Water and Waste Department will provide and install metering equipment and identification "donut" on hydrants once permits have been obtained.

.4 Provide approved backflow device with current test tag attached and an enclosure in accordance with SD-019 before using water from a hydrant.

3.8 Inspection of Existing Catch Basins and Manholes

.1 Inspect existing catch basins, curb inlets and manholes within and adjacent to the Site with the Contract Administrator to record the amount of debris inside before the start of construction and re-inspect after completion of construction and site cleanup.

.2 Clean catch basins, curb inlets and manholes as directed by the Contract Administrator in accordance with CW 2140 after completion of work.

.3 City will pay the portion of costs required for cleaning the amount of existing debris recorded before the start of construction as determined by the Contract Administrator.

4. MEASUREMENT AND PAYMENT

4.1 Existing Services, Utilities and Structures

.1 Work associated with this specification will not be measured for payment and will be included with Underground and Surface Works unless indicated otherwise in the Specifications.

.2 Repair of existing services, utilities and structures within and adjacent to the Site that are damaged due to carelessness during construction will be at own expense.

.3 Cost of permits for hydrant use and for water used from the City's water system will be at own expense unless indicated otherwise in the Specifications.

.4 Cleaning debris from catch basins, curb inlets and manholes within and adjacent to the Site due to construction activities will be at own expense.

CW 1130 - SITE REQUIREMENTS

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CW 1130 - SITE REQUIREMENTS

1. DESCRIPTION

.1 This specification covers requirements for regulatory activities within and adjacent to the Site during construction of the Work.

3. CONSTRUCTION METHODS

3.1 Site Safety

.1 Follow safety requirements of "W210 The Workplace Safety and Health Act" and "Guidelines for Confined Entry Work".

3.2 Safety In and Around Landfill Sites

.1 Contact the Water and Waste Department, Solid Waste Division to determine if the Site is within the boundary of an abandoned landfill, dump, disposal site or the adjacent control zone.

.2 Control zone of a landfill, dump or disposal site is an area in which specific policies apply with respect to development and construction. Control zones can vary in size from 15 metres to 90 metres beyond the boundary of a landfill, dump and disposal site.

.3 Notify the Solid Waste Division where the Work or a portion of the Work is within the control zone of a landfill, dump or disposal site.

.4 Obtain safety precaution guidelines from the Solid Waste Division and develop and submit a safe work plan acceptable to the Solid Waste Division before beginning work. The Safety precaution guidelines are in addition to Provincial regulatory requirements. Most restrictive requirements will govern.

3.3 Surface Restoration

.1 Restore damaged and disturbed surfaces within and adjacent to the Site as directed by the Contract Administrator where restoration is not indicated in the Specifications or shown on the Drawings.

.2 Restore damaged and disturbed surfaces to a condition equal to or better than original condition and in accordance with the City of Winnipeg Streets By-law.

.3 Maintain damaged and disturbed surfaces including pavements, boulevards, curbs, sidewalks, ditches and culverts as directed by the Contract Administrator until permanent repairs and restoration have been made.

.4 Complete permanent surface restorations within the time period identified in the Specifications or in accordance with the City of Winnipeg Streets By-law when the Work is being done under a permit.

.5 Damaged and disturbed surfaces not maintained as directed by the Contract Administrator or permanent surface restorations not completed within the specified time period may be maintained and restored by the City or its' designate in accordance with Clause GC:18 and

GC:19 of the General Conditions for Construction Contracts.

.6 Where work is being carried out on more than one street or one location, each street or location will be considered a separate Site. The Contract Administrator may direct that restoration be completed at previous Sites before allowing work to start at subsequent Sites if it is deemed restoration is falling behind the specified time requirements.

3.4 Disposal of Waste Material

.1 Haul and dispose of waste material excavated from the Site including surplus, suitable, unsuitable and other material removed in accordance with the Specifications to a disposal location approved by the Contract Administrator.

.2 The City reserves the right to direct material to be hauled to a local site indicated in the Specifications.

.3 Clean up material dropped or spilled during hauling operations as directed by the Contract Administrator.

3.5 Truck Travel Routes

.1 Follow truck travel routes identified in the Specifications or where not indicated in the Specifications use the shortest travel route to the closest designated truck route in accordance with The City of Winnipeg Traffic By-Law.

.2 Provide truck travel routes to the Contract Administrator for approval where routes are not identified in the Specifications.

3.6 Maintenance of Traffic and Access

.1 Maintain safe passage for vehicular and pedestrian traffic through the Site or divert traffic around the Site in accordance with the Drawings and Specifications and as directed by the Contract Administrator.

.2 Maintain and provide access to existing residences, buildings, driveways, parking lots and other locations in accordance with the Drawings and Specifications and as directed by the Contract Administrator.

.3 Pile and store construction materials and equipment in a location that will not interfere with ordinary use of streets and sidewalks or present a hazard to motorists and pedestrians.

3.7 Traffic Control

.1 Supply, erect, maintain and remove applicable traffic control devices, provide flag persons and follow traffic control procedures in accordance with the most recent edition of The City of Winnipeg, "Manual of Temporary Traffic Control on City Streets". The manual is only available online at:

http://winnipeg.ca/publicworks/trafficControl/manualTempTrafficControl.stm

.2 Immediately correct non-compliant traffic control signing as directed by the Contract Administrator. The Contract Administrator may suspend work until the improper signing is corrected. Claim for delay of work or contract extension due to this action will not be approved.

3.8 Parking Restrictions

.1 Provide a minimum of 48 hours notice to the Contract Administrator to allow arrangements to be made with The City of Winnipeg Traffic Services Branch and Winnipeg Parking Authority to implement parking restriction signing for regulated parking and parking meter hooding within and adjacent to the Site.

.2 Notify the Contract Administrator immediately upon completion of work to allow arrangements to be made with Traffic Services Branch and/or Winnipeg Parking Authority to reinstate parking.

.3 The City will pay costs for parking restriction signing for regulated parking and parking meter hooding required for City of Winnipeg Construction Contracts as approved by the Contract Administrator.

.4 Make own arrangements with The City of Winnipeg Traffic Services Branch and Winnipeg Parking Authority to implement parking restriction signing for regulated parking and parking meter hooding within and adjacent to the Site for work done under permit.

3.9 Dust Nuisance

.1 Take measures to prevent creation of dust nuisance from construction operations and public traffic within the Site and on haul routes used for hauling Materials to and from the Site.

.2 Clean streets with mechanical street sweepers during and after completion of work within the Site and on haul routes used for hauling materials to and from the Site to the satisfaction of the Contract Administrator.

3.10 Restricted Work Hours

.1 Provide a minimum of 48 hours notice to and obtain written permission from the Contract Administrator to perform work between 2200 hours and 0700 hours including Saturdays, Sundays or Civic or Public Holidays.

.2 Conform to applicable by-laws, ordinances, regulations and codes in accordance with Clause GC:6.11 and GC:6.12 of the General Conditions for work performed outside regular working hours regardless of Contract Administrator's approval.

3.11 Encroachment Onto Private Property

.1 Confine work to public right-of-ways and other designated City owned land and easements except if written permission has been given by the owner to enter onto private property. Provide the Contract Administrator with a copy of the written permission received prior to entering onto private property.

3.12 Temporary Relocation of Affected Structures

.1 Temporarily relocate portable structures such as benches, mail boxes, news boxes, waste bins or vending machines as directed by the Contract Administrator which will interfere with the construction of the Work. Move the portable structures back to their original location after completion of the Work unless otherwise directed by the Contract Administrator.

3.13 Damage to Existing Structures and Property

.1 Repair damage done to existing adjacent structures and properties during construction of the Work to the satisfaction of the owner and the Contract Administrator.

3.14 Protection of Survey Infrastructure

.1 Known survey infrastructure including survey posts, bars, cut crosses and geodetic control monuments located in the vicinity of the Work has been confirmed by the City of Winnipeg Geomatics Branch and is shown on the Drawings.

.2 Contact the Geomatics Branch, Survey Infrastructure Protection Program telephone line at 918-1360 (0800 to 1600 hours Monday to Friday excluding holidays) at least 3 days prior to starting the Work to allow Geomatics Branch to locate, mark and confirm the physical condition of known survey infrastructure in the vicinity of the Site. Further information is available at http://www.winnipeg.ca/ppd/surveys.stm#legal%20survey.

.3 Meet with a representative of the Geomatics Branch on site and sign a Survey Infrastructure Protection Form to accept responsibility to protect survey infrastructure from damage during construction.

.4 Contact the Geomatics Branch immediately upon completion of construction and restoration work to inspect survey infrastructure previously located and marked.

.5 Provide the Contract Administrator with 48 hours notice to permit referencing for future replacement where a survey post, bar or control monument lies in the line of the work and will be disturbed. Failure to provide this notice will result in paying costs associated with replacing or relocating the disturbed survey infrastructure.

.6 Arrange for restoration of survey infrastructure as directed by the Geomatics Branch that has been disturbed, moved, covered, mutilated or destroyed by careless construction. Estimated cost to restore each legal survey monument is $1,000.00 and $3,000.00 for each control monument.

3.15 Stakes and Marks

.1 The Contract Administrator will mark to the extent determined necessary, the location, alignment and elevation of the work by means of stakes or marks. Conform the completed works to the stakes, marks and lines indicated.

.2 The Contract Administrator will provide stakes and marks for the Work no later than 1 Working Day following the day provision of stakes and marks is requested.

.3 Notify the Contract Administrator immediately of the disturbance of stakes and marks provided for the Work. Correct errors arising out of neglect to notify the Contract Administrator of disturbed stakes and marks.

.4 Determine the meaning and correctness of stakes and marks set by the Contract Administrator before starting the Work. If an error is suspected in the Drawings, Specifications or the directions of the Contract Administrator, Work will be discontinued until the error is rectified. No claim will be made due to alleged inaccuracies in the stakes and marks and for delay in the Work to rectify an error.

.5 Determine and provide dimensions and elevations measured from the stakes or marks provided by the Contract Administrator.

3.16 Verification of Weights

.1 Use a scale certified by Measurement Canada to weigh material being paid for on a weight basis.
.2 Weight tickets to have gross weight, time and date of weighing printed by an approved electro/mechanical printer coupled to the scale. Tare weight and net weight may be either hand written or machine printed.

.3 Provide access for Contract Administrator to inspect and verify the following items.

.1 Current certification seals from Measurement Canada are affixed to weigh scales.

.2 Weighing procedures.

.3 Check of either gross or tare weight for randomly selected trucks or truck trailer units by weighing on nearest available certified scale.

.4 Check of tare weights shown on delivery tickets against current tare of trucks and truck/trailers.

.4 Ensure that each truck and truck trailer delivering material that will be paid for on a weight basis carries a tare not more than 1 month old.

.5 Show the following information on weight tickets for truck and truck/trailer combinations weighed on a certified scale.

.1 Scale that truck or truck trailer was weighed on.

.2 Mechanically printed tare weight.

.3 License number(s) of truck and trailer(s) tare is for.

.4 Time and date of weighing.

3.17 Truck Weight Limits

.1 Ensure that trucks and truck/trailers do not exceed the maximum gross vehicle weight allowed under The City of Winnipeg Traffic By-Law, unless the vehicle is operating under special permit. The City will not pay for the portion of Material that results in the vehicle exceeding allowable gross vehicle weight.

3.18 Information Signs

.1 Obtain permission from the Contract Administrator to erect information signs.

.2 Remove approved information signs promptly after Work is completed.

4. MEASUREMENT AND PAYMENT

4.1 Construction Site Requirements

.1 Work associated with this specification will not be measured for payment and will be included with Underground or Surface Works unless indicated otherwise in the Specifications.

.2 Costs for maintenance and restoration of disturbed surfaces performed by the City or its' designate will be deducted from payments owed.

.3 Restoration of survey infrastructure disturbed, moved, covered, mutilated or destroyed by careless construction will be at own expense or will be deducted from payments owed.

.4 Correction of errors arising from neglect to notify the Contract Administrator of disturbed stakes and marks will be at own expense.

CW 2030 - EXCAVATION BEDDING AND BACKFILL

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CW 2030 - EXCAVATION BEDDING AND BACKFILL

1. DESCRIPTION

1.1 General

.1 This specification covers excavation, trenching, disposal of excess or unsuitable excavated material, shoring, foundations, bedding, backfilling and compaction required for the installation of Underground Works.

1.2 Definitions

.1 Excavation will include trenches and shafts.

.2 Shaft means a vertical or inclined opening excavated below ground level.

.3 Trench means an excavation having a depth which exceeds its width measured at the bottom.

.4 Shoring will include, bracing, sheeting, planking, circular steel sleeves and trench cages.

.5 Solid rock and concrete excavation is defined as boulders, rock, concrete rubble and foundations greater than 0.5 cubic metres in volume as well as bedrock, consolidated glacial till or hardpan and buried concrete pavements that requires blasting, drilling, splitting or breaking with additional equipment before being removed from excavations using normal mechanical excavation equipment.

.6 Frozen material will not be considered rock excavation.

.7 Trenchless installation methods are methods of installing pipe inside a hole that has been made between shafts by coring, boring, horizontal directional drilling, jacking, tunnelling and extraction of an existing pipe or similar methods with minimal excavation and surface disruption.

1.3 Referenced Standard Construction Specifications

.1 CW 1120 - Existing Services, Utilities and Structures
.2 CW 1130 – Site Requirements
.3 CW 2160 – Concrete Underground Structures and Works
.4 CW 3230 - Full-Depth Patching of Existing Slabs and Joints
.5 CW 3235 - Renewal of Existing Miscellaneous Concrete Slabs
.6 CW 3240 - Renewal of Existing Curbs

1.4 Referenced Standard Details

.1 SD-001 – Standard Pipe Bedding Classes
.2 SD-002 – Standard Trench and Excavation Backfill Classes
.3 SD-003 - Jetting Nozzle Insertion Locations

2. MATERIALS

2.1 Bedding and Backfill

.1 Type 1 material is to consist of well graded pit-run material conforming to the grading requirements of Table CW 2030.1

.2 Type 2 and Type 3 material is to consist of sound, hard, crushed rock or crushed gravel free from organic or soft material that would disintegrate through decay or weathering, well graded throughout conforming to the grading requirements of Table CW 2030.1. Type 2 material is to have a 100% crush content and be well graded throughout.

.3 Material passing the 315 micrometre sieve is to have a liquid limit not greater than 25 and a plasticity index not greater than 6.

.4 Sand is to be clean and free running conforming to the grading requirements of Table CW 2030.1. Use dry sand when freezing conditions occur.

.5 Type 1, Type 2 and Type 3 material is to have a loss of not more than 35% when subjected to abrasion testing in accordance with Grading B of ASTM C131.

TABLE CW 2030.1 - GRADING REQUIREMENTS FOR IMPORTED BACKFILL

Canadian Metric Sieve Size	Percent of Total Dry Weight Passing Each Sieve			
	Type 1 Material	Type 2 Material	Type 3 Material	Sand
75 000	90% - 100%			
28 000	80% - 100%		100%	
20 000		100%		
10 000				100%
5 000	40% - 80%	40% - 70%	0% - 5%	90% - 100%
2 500		25% - 60%		
630				25% - 60%
315	10% - 35%	8% - 25%		
80	5% - 30%	6% - 17%		0% - 3%

.6 Imported clay material is to be low to medium plastic clays with liquid limit <50 or mixtures of clay and sand suitable for compaction and is to be free of silt, rock, concrete rubble and organic materials. Material is to be approved by the Contract Administrator before placing in excavations.

2.2 Cement-Stabilized Fill

.1 Cement-stabilized fill to be in accordance with Table CW 2160.1 of CW 2160.

2.3 Flowable Cement-Stabilized Fill

.1 Flowable cement-stabilized fill is to be in accordance with Table CW 2160.1 of CW 2160.

2.4 Concrete Bedding

.1 Concrete bedding to be in accordance with Table CW 2160.1 of CW2160.

2.5 Material Testing Methods

.1 Imported bedding and backfill material will be subject to inspection and testing by the Contract Administrator or by the testing laboratory designated by the Contract Administrator. Notify the Contract Administrator at least 7 days before construction starts of sites where imported backfill material will be obtained. Provide material samples for testing at no cost to the Contract Administrator. Replace imported backfill materials that do not conform in whole or in part to this specification.

.2 Standard Proctor Density for materials used for bedding and backfill will be determined in accordance with ASTM D698. Field density of materials will be calculated as a percentage of Standard Proctor Density.

.3 Field density of unexcavated and compacted backfill materials will be verified by field density tests in accordance with ASTM Standard D2922.

.4 Frequency and number of tests will be determined by the Contract Administrator.

.5 Fill holes made by the removal of testing samples from compacted backfill and unexcavated material promptly with appropriate material and compact to match adjacent compacted material.

3. CONSTRUCTION METHODS

3.1 Site Drainage and Excavation Dewatering

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

.2 Maintain existing site drainage around excavations.

.3 Protect open excavations from flooding and damage due to rainfall and surface run-off.

.4 Do not direct drainage water from ground surface or excavations into existing sewer system without written approval of the Contract Administrator.

3.2 Pavement Removal

.1 Remove existing pavement in accordance with specifications CW 3230, CW 3235 and CW 3240.

3.3 Excavation

.1 Perform excavation in accordance with Province of Manitoba "W210 The Workplace Safety and Health Act" and "Guidelines for Excavation Work".

.2 Excavate to the lines, grades, elevations and dimensions shown on the Drawings and set in the field by the Contract Administrator.

.3 Excavate the additional depth required for bedding and foundation material in accordance with SD-001 and the Drawings.

.4 Ensure the bottom of the excavation is smooth, free from depressions, lumps and protruding objects.

.5 Maximum trench width from the underside of the pipe bedding and foundation to 600 millimetres above the top of the pipe to be the greater of 1200 millimetres or the outside diameter of the pipe plus 750 millimetres.

.6 Where the maximum trench width is exceeded due to unstable soil conditions or over-excavation, the Contract Administrator will review the external loading condition on the pipe to determine if the class of bedding and pipe type or strength specified needs to be upgraded.

.7 Remove unsuitable soil from bottom of excavation as directed by the Contract Administrator.

.8 Fill over-excavation to required elevation with Type 1, Type 2 or Type 3 material as directed by the Contract Administrator and compact to at least 95% of Standard Proctor Density.

3.4 Solid Rock and Concrete Excavation

.1 Over-excavate solid rock and concrete an additional 150 millimetres below the underside of the required bedding for full width of trenches and 300 millimetres beyond largest outside dimension of manholes, catch basins and structures unless otherwise indicated in the Drawings, and Specifications or directed by the Contract Administrator.

.2 Where blasting is required, retain a certified blaster who is qualified to handle and use explosives to supervise preparations, precautions and perform rock blasting operations. Carry out rock blasting in accordance with local regulations, Province of Manitoba Workplace, Health and Safety Act W210 and Federal Explosives Act.

.3 Fill over-excavation to underside of required bedding with Type 2 or Type 3 material as directed by the Contract Administrator compacted to at least 95% of Standard Proctor Density.

3.5 Shoring

.1 Provide shoring in accordance with Province of Manitoba "W210 The Workplace Safety and Health Act" and "Guidelines for Excavation Work".

.2 Use suitable type of shoring for soil conditions.

.3 Provide shoring design stamped, signed and dated by a Professional Engineer experienced in shoring design and licensed to practice in Province of Manitoba when required in the Specifications.

.4 Install shoring in a manner to support sides of excavation and prevent ground movement that may damage pipes and structures being constructed and cause damage to existing adjacent pavements, buildings and other structures.

.5 Use type or method of shoring that will not disturb the compacted foundation and bedding when being removed.

.6 Arrange with the Professional Engineer who designed the shoring system to inspect the shoring system during construction and certify, in writing to the Contract Administrator, that construction is in conformance with the approved design.

.7 Leave the shoring system in place until such time as the Professional Engineer who designed the shoring system has provided written approval to remove. Provide a copy of the written approval to the Contract Administrator before removal.

.8 Remove shoring from excavations as backfilling proceeds unless otherwise indicated in the Specifications or directed by the Contract Administrator to leave shoring permanently in place. Cut-off shoring permanently left in place 1.2 metres below grade unless otherwise indicated in the Specifications or directed by the Contract Administrator.

.9 Repair pavements, boulevards, pipes, utilities and structures as directed by the Contract Administrator that are damaged or disturbed by shoring failure or when removing shoring.

3.6 Disposal of Unsuitable or Surplus Excavated Material

.1 Dispose of unsuitable and surplus excavated material in accordance with Specification CW 1130.

3.7 Foundation, Bedding and Backfill

.1 Remove boulders, rocks or concrete larger than 50 millimetres in size, ice, snow, frozen material, organic material, or debris from bottom of excavation before placing foundation or bedding material.

.2 Provide a foundation consisting of Type 3 material over the entire bottom of shafts made for trenchless installation in accordance with SD-001. Compact to a density of at least 95% of Standard Proctor Density. Foundations will not be required in shafts for watermains unless directed otherwise by the Contract Administrator.

.3 Place bedding material in excavations and under pipe haunches in accordance with SD-001. Compact to a density of at least 95% of Standard Proctor Density.

.4 Type 2 and Type 3 material can be substituted for sand where sand is specified for the bedding and initial backfill material.

.5 Place specified initial backfill around and over the pipe to the height shown on SD-001 and compact to a density of at least 95% of Standard Proctor Density using methods and equipment that will not damage the pipe.

.6 Backfill the remainder of the excavation as follows with specified class of backfill in accordance with Section 3.8 of this specification and SD-002.

.1 Trenches and excavations located within existing paved areas and areas proposed to be paved: Class 1, Class 2 or Class 3 Backfill as indicated on the Drawings and Specifications or as directed by the Contract Administrator.

.2 Trenches and excavations within 1 metre of a paved area: Class 3 Backfill.

.3 Trenches and excavations located within a boulevard or grassed area: Class 4 or Class 5 Backfill as indicated on the Drawings and Specifications or as directed by the Contract Administrator.

.7 Ensure adequate cover is provided over the pipe to protect it from being damaged by backfill placed and equipment used for compaction.

.8 Repair pavements, boulevards, pipes, utilities and structures as directed by the Contract Administrator that are damaged or disturbed by settlement of backfill in trenches and excavations.

3.8 Classes of Backfill

.1 Class 1 Backfill

.1 Backfill the excavation with Type 1 material compacted in accordance with Clause 3.8.2 or 3.8.3 of this specification to within 1 metre of the underside of pavement**.** Fill the remainder of the excavation with cement-stabilized fill to the required depth below finished pavement in accordance with the Drawings and Specifications or as directed by the Contract Administrator.

.2 Class 2 Backfill

.1 Backfill the excavation with Type 1 material in maximum 300 millimetre thick layers to the grade required for backfill in accordance with the Drawings and Specifications or as directed by the Contract Administrator. Compact each layer with a vibratory compactor to at least 95% of Standard Proctor Density. Obtain approval from the Contract Administrator before proceeding with next layer.

.3 Class 3 Backfill

.1 Backfill the excavation with Type 1 material to grade required for backfill in accordance with the Drawings and Specifications or as directed by the Contract Administrator. Compact backfill material by jetting, flooding and tamping in accordance with Section 3.9 of this specification.

.4 Class 4 Backfill

.1 Backfill the excavation with suitable excavated material in maximum 600 millimetre thick layers to the grade required for backfill in accordance with the Drawings and Specifications or as directed by the Contract Administrator. Compact each layer by mechanical means to a density equivalent to that of the surrounding unexcavated material. Obtain approval from the Contract Administrator before proceeding with next layer.

.5 Class 5 Backfill

.1 Backfill the excavation with suitable excavated material to the grade required for backfill in accordance with the Drawings and Specifications or as directed by the Contract Administrator. Compact backfill material by jetting, flooding and tamping in accordance with Section 3.9 of this specification.

3.9 Jetting, Flooding and Tamping of Backfill

.1 Make arrangements for water supply source in accordance with Specification CW 1120.

.2 Use a minimum 25 millimetre diameter rigid pipe of suitable length for jetting excavations.

.3 Insert the jetting pipe into the backfill to within 1 metre of the top of the pipe allowing the water jetting action to determine the rate at which the jetting pipe is worked through the backfill.

.4 Locate jetting insertions in accordance with SD-003.

.5 Continue jetting until water rises above top surface of backfill and begins to pond.

.6 Tamp backfill with a backhoe mounted vibratory plate compactor once surface water has sufficiently dried.

.7 Place and compact additional specified backfill material to maintain top surface of backfill at required elevation.

3.10 Excavation and Backfill Where New Pipes Cross Existing Pipes

.1 New pipes being installed in a trench cross above an existing pipe trench.

.1 Excavate to 600 millimetres below bottom of new pipe or to top of existing pipe whichever is lesser for a length along the existing pipe of 1500 millimetres or the existing pipe diameter plus 600 millimetres which ever is greater.

.2 Backfill to the underside of the bedding required for new pipe with Class 2 Backfill unless

indicated otherwise in the Drawings and Specifications or directed by the Contract Administrator.

.2 New pipes being installed in a trench cross below an existing pipe trench.

.1 Support or remove and replace a section of the existing pipe to allow installation of new pipe.

.2 Backfill the excavation for the new pipe with Class 2 Backfill to the underside of bedding required for existing pipe unless indicated otherwise in the Drawings and Specifications.

.3 Bed the new pipe and backfill the remainder of the excavation in accordance with Clause 3.7.6 of this specification unless indicated otherwise in the Drawings and Specifications or directed by the Contract Administrator.

3.11 Excavation and Backfill of Parallel Pipes

.1 Support and protect the higher pipe as required where excavation of the lower pipe will disturb the ground under the higher pipe.

.2 Backfill the lower pipe excavation to the invert of the higher pipe with Class 2 Backfill unless indicated otherwise in the Drawings and Specifications or directed by the Contract Administrator.

.3 Bed the new pipe and backfill the remainder of the excavation in accordance with Clause 3.7.6 of this specification unless indicated otherwise in the Drawings and Specifications or directed by the Contract Administrator.

3.12 Filling Underground Voids With Cement Stabilized Fill

.1 Fill underground voids as indicated in the Drawings and Specifications or directed by the Contract Administrator with cement-stabilized fill. Obtain approval from the Contract Administrator to make additional excavations to accommodate the placement of cement-stabilized fill.

3.13 Restoration

.1 Restore surfaces in accordance with the Drawings and Specifications, applicable By-Laws if the work being done under a Permit or as directed by the Contract Administrator.

4. MEASUREMENT AND PAYMENT

4.1 Site Drainage and Excavation Dewatering

.1 Site drainage and excavation dewatering will be included with construction of the underground works.

4.2 Excavation

.1 Excavation and disposal of surplus excavated material will be included with construction of the underground Works.

.2 Upgrading of bedding, pipe type and strength as directed by the Contract Administrator due to over excavation beyond the specified limits will be at own expense.

4.3 Excavation of Unsuitable Material

.1 Excavation and disposal of unsuitable material will be measured on a volume basis and paid for at the Contract Unit Price per cubic metre for "Excavation of Unsuitable Material". Volume to be paid for will be the total number of cubic metres of unsuitable material excavated and disposed of in accordance with this specification, accepted and measured by the Contract Administrator.

.2 Excavated material will be measured by cross sections in its original position and the volume computed using the method of Average End Areas.

.3 Upgrading of bedding, pipe type and strength as directed by the Contract Administrator due to unsuitable soil conditions will be paid for as an authorized Change in Work.

4.4 Solid Rock and Concrete Excavation

.1 Excavation and disposal of solid rock and concrete will be measured on a volume basis and paid for at the Contract Unit Price per cubic metre for "Solid Rock and Concrete Removal". Volume to be paid for will be the total number of cubic metres of solid rock and concrete excavated and disposed of in accordance with this specification, accepted and measured by the Contract Administrator.

.2 Solid rock and concrete removal will be measured by cross sections in its original position and the volume computed using the method of Average End Areas.

.3 Over excavation of solid rock and concrete beyond the specified limits will be at own expense.

4.5 Backfill Material to Replace Rock and Unsuitable Material

.1 Backfill material required to replace rock and unsuitable material will be measured on a volume basis for each type of backfill and paid for at the Contract Unit Price per cubic metre for "Backfill Material". Volume to be paid for will be the total number of cubic metres of Backfill supplied, placed and compacted in accordance with this specification, accepted and measured by the Contract Administrator.

.2 Backfill material will be measured by cross sections in its compacted position and the volume computed using the method of Average End Areas.

.3 Backfill material required for over excavation beyond specified limits will be at own expense.

4.6 Shoring

.1 Supply, installation and removal of shoring will be included with construction of the underground work.

.2 Repair of damage to existing pavements and structures adjacent to the excavation caused by careless installation and removal of shoring will be at own expense.

.3 Replacement and re-compaction of bedding disturbed by removal of shoring will be at own expense.

4.7 Shoring Left in Place

.1 Shoring specified or directed to be left in place will be measured on an area basis and paid for at the Contract Unit Price for "Shoring Left in Place". Area to be paid for will be total number of square metres of shoring installed and left in place in accordance with this specification, accepted and measured by the Contract Administrator.

.2 Measurement will be made by multiplying the height of the shoring left in place by the perimeter of the excavation.

4.8 Foundation, Bedding and Backfill

.1 Supply and installation of foundation, bedding and backfill for pipe and other structures will be included with construction of the underground works.

.2 Where granular or cement-stabilized backfill material is directed by the Contract Administrator to be used in place of the specified backfill material it will be measured on a volume basis for each type of backfill and paid for at the Contract Unit Price per cubic metre for "Granular Backfill Material" and "Cement-Stabilized Backfill Material". Volume to be paid for will be the total number of cubic metres of Backfill supplied, placed and compacted in place in accordance with this specification, accepted and measured by the Contract Administrator.

.3 The unit price provided for granular or cement-stabilized backfill material used in place of the specified backfill will be the incremental cost of the material above and beyond the cost of the volume of the specified backfill being replaced.

.4 Repair of damage to pavements, boulevards, pipes, utilities and structures resulting from settlement of excavations will be at own expense.

4.9 Jetting, Flooding and Tamping of Backfill

.1 Jetting, flooding and tamping of backfill will be included with construction of the underground works.

4.10 Filling Underground Voids With Cement Stabilized Fill

.1 Filling underground voids with cement-stabilized fill will be measured on a volume basis and paid for at the Contract Unit Price for "Filling Underground Voids With Cement-Stabilized Fill". Volume to be paid for will be the total number of cubic metres of cement stabilized fill supplied and placed in accordance with this specifications, accepted and measured by the Contract Administrator.

.2 Measurement for cement stabilized fill will be made by calculating the volume of the void being filled.

4.11 Backfill for Parallel Pipes

.1 Backfill for parallel pipes will be measured on a length basis and paid for at the Contract Unit Price for "Backfill for Parallel Pipes". Length to be paid for will be the total number of linear

metres of backfill supplied and placed in accordance with this specification, accepted and measured by the Contract Administrator.

.2 Measurement of backfill for parallel pipes will be made horizontally at grade along the centreline of the trench of the lower pipe.

CW 2110 - WATERMAINS

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CW 2110 - WATERMAINS

1. DESCRIPTION

1.1 General

.1 This specification covers supply and installation of watermains, watermain renewals, fittings, hydrant assemblies, valves, water services, connections to existing watermains, watermain repairs, appurtenances and related work.

1.2 Definitions

.1 Fittings include main line tees, wyes, bends, crosses, reducers, couplings and plugs.

.2 Appurtenances include repair clamps, tapping sleeves and connection saddles.

.3 Hydrant assemblies include the tee on the watermain for the hydrant, 150 millimetre hydrant lead pipe from the watermain, valve on hydrant lead pipe, fittings, pre-cast concrete base block and cast-in-place concrete thrust blocks in accordance with SD-006 and SD-007.

.4 Trenchless installation methods are methods of installing pipe inside a hole that has been made between shafts by coring, boring, horizontal directional drilling, jacking, tunnelling and extraction of an existing pipe or similar methods with minimal excavation and surface disruption.

1.3 Referenced Standard Construction Specifications

.1 CW 1120 - Existing Services, Utilities and Structures
.2 CW 2030 - Excavation, Bedding and Backfill
.3 CW 2160 - Concrete Underground Structures and Works
.4 CW 2125 - Flushing, Hydrostatic Leakage Testing and Disinfection of Watermains and Water Services
.5 CW 3150 – Gravel Surfacing
.6 CW 3230 - Full-Depth Patching of Existing Slabs and Joints
.7 CW 3235 - Renewal of Existing Miscellaneous Concrete Slabs
.8 CW 3240 - Renewal of Existing Curbs
.9 CW 3310 – Portland Cement Concrete Pavement Works
.10 CW 3410 - Asphaltic Concrete Pavement Works
.11 CW 3510 - Sodding
.12 CW 3520 - Seeding

1.4 Referenced Standard Details

.1 SD-001 – Standard Pipe Bedding Classes
.2 SD-002 – Standard Trench and Excavation Backfill Classes
.3 SD-004 – Concrete Thrust Blocks for Horizontal Watermain Fittings
.4 SD-005 – Concrete Thrust Blocks for Vertical Watermain Fittings
.5 SD-006 - Standard Fire Hydrant Assembly
.6 SD-007 - Short Fire Hydrant Assembly
.7 SD-008 – Location Map For Watermain Valve Closing Direction
.8 SD-012 – Water Service 20 Millimetre to 50 Millimetre
.9 SD-013 - Small Diameter Copper Watermain For Cul-de-Sac Loop
.10 SD-016 – Standard Watermain Valve Installation
.11 SD-017 – By Pass Valve Assembly for 350 to 450 Millimetre Watermains
.12 SD-018 - Watermain and Water Service Insulation

1.5 Referenced Approved Products

.1 AP-001 – Standard Valve Box
.2 AP-013 - Minneapolis Style Curb Box for 20 and 25 Millimetre Minneapolis Style Curb Stops
.3 AP-014 - Minneapolis Style Curb Box for 38 and 50 Millimetre Minneapolis Style Curb Stops

2. MATERIALS

2.1 Approved Products

.1 Use only those products listed as Approved Products for Underground Use in the City of Winnipeg found on the City of Winnipeg, Materials Management web site at: http://www.winnipeg.ca/matmgt/spec/

2.2 Watermain and Water Service Pipe

.1 150 to 300 millimetre watermain pipe in accordance with AT 4.1.1.10 of the Approved Products for Underground Use in the City of Winnipeg.

.2 350 to 500 millimetre water service in accordance with AT 4.1.1.11 of the Approved Products for Underground Use in the City of Winnipeg.

.3 19 to 50 millimetre water service in accordance with AT 4.1.2.10 of the Approved Products for Underground Use in the City of Winnipeg.

2.3 Watermain and Large Diameter Water Service Fittings

.1 PVC injection moulded fittings.

.1 150 and 200 millimetre tees, elbows and tapped couplings in accordance with AT 4.1.1.61 of the Approved Products for Underground Use in the City of Winnipeg.

.2 150 to 300 millimetre couplings and plugs in accordance with AT 4.1.1.61 of the Approved Products for Underground Use in the City of Winnipeg.

.2 PVC fabricated fittings

.1 250 and 300 millimetre tees, elbows, crosses, couplings, reducers, and caps in accordance with AT 4.1.1.64 of the Approved Products for Underground Use in the City of Winnipeg.

.3 Cast iron fittings

.1 150 millimetre and larger cast iron fittings in accordance with AT 4.1.1.60 of the Approved Products for Underground Use in the City of Winnipeg.

2.4 Watermain and Large Diameter Water Service Pipe Gaskets

.1 Rubber gaskets in accordance with ASTM F477.

.2 Where required, elastomeric compounds for oil and gas resistant gaskets to be rated as "excellent".

2.5 Small Diameter Water Service Fittings

.1 19 to 50 millimetre ASTM B62 composition bronze high-pressure with flared ends for copper water

service connections in accordance with AWWA C800.

.2 19 to 50 millimetre water service plugs to ASTM B62 composition bronze high-pressure with AWWA taper thread in accordance with AWWA C800.

2.6 Hydrants

.1 Post type, dry barrel with compression shutoff in accordance with CAN/ULC-S250 and AWWA C502.

.2 Designed for working pressure of 1.0 MPa

.3 Provided with two 65 millimetre threaded hose outlets, one 100 millimetre threaded pumper connection, 150 millimetre riser barrel with break away flange, 125 millimetre bottom valve and 150 millimetre bottom inlet with push-on joint with harnessing lugs for watermain lead pipe connection.

.4 Drain to be omitted or plugged.

.5 Hydrants to open counter clockwise.

.6 Components used for hydrant adjustment purposes including barrel extensions, stem extensions, stem couplings, breakaway flanges or kits, rubber seals, flange gaskets and fasteners to be original equipment manufacture (OEM) for the style of hydrant being adjusted.

2.7 Valves and Valve Boxes

.1 150 to 400 millimetre, direct bury, non-rising stem, resilient seated wedge gate valve rated at 1 MPa in accordance with AT 4.1.1.80 of the Approved Products for Underground Use in the City of Winnipeg.

.2 Valve body to be epoxy coated in accordance with AT 4.1.1.80 of the Approved Products for Underground Use in the City of Winnipeg.

.3 Valve ends to be push-on type with full depth insertion in accordance with AT 4.1.1.80 of the Approved Products for Underground Use in the City of Winnipeg.

.4 Direction of closing to be in accordance with SD-008.

.5 Valve boxes to be in accordance with AP-001 and AT 4.1.1.81 of the Approved Products for Underground Use in the City of Winnipeg.

2.8 Corporation Stops

.1 19 to 50 millimetre corporation stops to be in accordance with AT 4.1.1.31 of the Approved Products for Underground Use in the City of Winnipeg.

2.9 Curb Stops and Curb Stop Boxes

.1 19 to 50 millimetre curb stops to be in accordance with AT 4.1.2.40 of the Approved Products for Underground Use in the City of Winnipeg.

.2 Curb stop boxes to be in accordance with AP-013 and AP-014 and in accordance with AT 4.1.2.41 of the Approved Products for Underground Use in the City of Winnipeg.

2.10 Watermain Appurtenances

.1 Repair clamps to be in accordance with AT 4.1.1.69 of the Approved Products for Underground Use in

the City of Winnipeg.

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.2 Mainline and wide range couplings to be in accordance with AT 4.1.1.63 and AT 4.1.1.65 of the Approved Products for Underground Use in the City of Winnipeg.

.3 Tapping sleeves to be in accordance with AT 4.1.1.70 of the Approved Products for Underground Use in the City of Winnipeg.

.4 Connection saddles to be in accordance with AT 4.1.1.30 of the Approved Products for Underground Use in the City of Winnipeg.

.5 Fasteners, tie rods, clamps, nuts and bolts to be stainless steel in accordance with ASTM Specification A320. ANSI Type 316 marked with raised or indented numerals.

.6 Joint harness for PVC fittings in accordance with ASTM F1674.

.7 Corrosion protection wrapping in accordance with AWWA C217. Acceptable product, Denso LT Petroleum Tape.

.8 Rigid extruded polystyrene foam insulation in accordance with CSGB Specification 51-GP20M (Type 4).

.9 Zinc anodes to be in accordance with AT 4.1.3.20 of the Approved Products for Underground Use in the City of Winnipeg.

.10 Continuity bonding wire to be #6 AWG 7 strand copper wire with TWU minus 40 degree C insulation (colour: green).

.11 Polyethylene wrap in accordance with CAN/CGSH-51.34M. Thickness to be 0.15 millimetres (6 mil).

2.11 Watermain Casing Pipe

.1 Black steel in accordance with ASTM A53 thickness to be in accordance with the Drawings and Specifications.

2.12 Cast-in-Place Concrete and Grout

.1 Cast-in-place concrete and grout in accordance with CW 2160.

2.13 Bedding and Backfill Material

.1 Bedding and backfill material in accordance with CW 2030.

2.14 Temporary Pressurized Water Supply Pipe

.1 Temporary pressurized water supply pipe and fittings to be in accordance with CAN-B137 and be suitable for outdoor exposure, pressure rated service and meet National Sanitation Foundation Standard #14 & #61 for plastic piping system components and related materials.

3. CONSTRUCTION METHODS

3.1 Excavation

.1 Remove existing pavement in accordance with CW 3230, CW 3235, CW 3240 and CW 3410.

.2 Excavate in accordance with CW 2030. Excavate and prepare trench a sufficient distance in ahead to not to interfere with installation of the pipe.

3.2 Bedding

.1 Place and compact sand bedding material in the bottom of the excavation in accordance with CW 2030 and SD-001 to the grade and elevation shown on the Drawings. Level across full width of excavation and leave ready for pipe installation.

.2 Foundation material will not be required in shafts for watermains installed using trenchless methods unless indicated otherwise in the Drawings and Specifications or directed by the Contract Administrator.

3.3 Installation in a Trench

.1 Assemble and install pipe in accordance with the manufacturer's instructions and AWWA Manual of Water Supply Practices M23, PVC Pipe – Design and Installation. When complete the watermain is to have a smooth and uniform invert.

.2 Place pipe on compacted bedding ensuring uniform support under bell and pipe body throughout its full length. Work and compact bedding material under sides of pipe to provide proper haunching.

.3 Protect exposed pipe ends with an approved stopper to prevent excess amounts of water, earth and debris from entering pipe as work proceeds.

.4 Install pipe to the line and grade shown on the Drawings or as determined by the Contract Administrator in the field within a horizontal and vertical variance of +/- 100 millimetres.

.5 Pipe joint deflections to be within the manufacturer's recommendations.

3.4 Installation Using Trenchless Methods

.1 Install watermain using trenchless methods where alignment is under or crosses existing and proposed pavements, existing boulevards, trees, utility poles and structures and at other locations in accordance with the Drawings and Specifications or as directed by the Contract Administrator.

.2 Excavate shafts and provide shoring in accordance with CW 2030.

.3 Provide the locations and sizes of shafts to the Contract Administrator for review before excavating.

.4 Join pipe sections together before inserting into the installation hole. Pull or push the entire length of pipe from the end of the last pipe into installation hole with bell ends facing away from the pulling or pushing direction. Installation methods where tension is applied to a pipe section will not be permitted.

.5 Ensure the force applied to the section of pipe being pulled or pushed into the installation hole does not cause spigots to be inserted into the bell beyond the manufacturer's recommended insertion depth.

.6 Pull back the entire length of pipe already in the installation hole if a length of pipe is to be withdrawn from the installation hole.

.7 Plan trenchless installation operation to join watermain pipe sections at fitting and valve locations without using extra couplings.

.8 Remove existing watermains by the extraction method and install the new watermain in the remaining hole where new watermains are installed on the same horizontal and vertical alignment as the existing

watermain.

.9 Place pipe on compacted bedding in shafts ensuring uniform support under bell and pipe body throughout its full length. Work and compact bedding material under sides of pipe to provide proper haunching.

.10 Protect exposed pipe ends with an approved stopper to prevent excess amounts of water, earth and debris from entering pipe as work proceeds.

.11 Install pipe to the line and grade shown on the Drawings or as determined by the Contract Administrator in the field within a horizontal and vertical variance of +/- 100 millimetres.

.12 Keep pipe joint deflections within the manufacturer's recommendations.

.13 Repair damage to underground and surface structures due to surface subsidence and soil heaving caused by trenchless installation methods.

.14 Where field conditions are such that watermains cannot be installed using trenchless methods install watermains in a trench using the class of backfill specified in CW 2030 for the installation location after receiving written approval from the Contract Administrator.

3.5 Installation in a Casing Pipe

.1 Install the steel casing pipe of the specified thickness and diameter at the location, limits, line and grade shown on the Drawings using trenchless methods. Join individual casing pipe lengths with a continuous weld.

.2 Securely attach 4 equally spaced cedar straps, skids or blocks or manufactured casing spacers around the watermain arranged at 45 degrees to the horizontal and vertical axis of the pipe. The straps, blocks, skids or spacers should be sized to ensure the watermain does not rest on the pipe bells and is centred within +/-10% of the centreline of the casing pipe.

.3 Cedar straps, blocks or skids can be the full length of the watermain pipe except for the bell or of the length and spacing recommended by the pipe manufacturer to provide proper support.

.4 Install the watermain inside the casing pipe in accordance with Clauses 3.4.4, 3.4.5 and 3.4.6 of this specification.

3.6 Extraction of Existing Watermain to be Abandoned

.1 Extract the existing watermain between shafts where the new watermain is to be installed by trenchless methods directly below an existing watermain that will be abandoned.

3.7 Backfill

.1 Place and compact initial backfill above the pipe in accordance with CW 2030 and SD-001.

.2 Backfill the reminder of the trench or excavation in accordance with CW 2030 and SD-002.

3.8 Hydrant Assembly Installation

.1 Install hydrant assembly in accordance with SD-006 and SD-007.

.2 Install hydrant plumb with pumper nozzle perpendicular to and facing the street.

.3 Construct concrete thrust block at base of hydrant to not interfere with base flange barrel bolts.

.4 Install hydrant assembly to the line and grade shown on the Drawings or as determined by the Contract Administrator in the field within a horizontal and vertical variance of +/- 100 millimetres.

.5 Locate hydrant flange 50 to 150 millimetres above finished grade elevation.

.6 Install new hydrant assembly on an existing watermain as follows.

.1 Excavate and expose the existing watermain at location shown on the Drawings or as directed by the Contract Administrator.

.2 Cut existing pipe square to axis and remove the required length of pipe.

.3 Install required fittings, new pipe, thrust blocks, couplings and other material necessary to make the connections. Install new gaskets in bell ends of existing pipe or fittings.

.4 Provide a 1000 millimetre length of PVC pipe on each side of a new hydrant tee installed on an existing Asbestos-Cement watermain.

.5 Install a continuity bonding wire between ends of cast and ductile iron watermains that have been replaced with a length of PVC pipe. Prepare an area 50 millimetres square on the top of the pipe surface by grinding or filing to bare metal and attach the continuity bonding wire using the Thermite Welding process (Cadwelding).

.6 Alternatively install a tapping sleeve in accordance with Section 3.14 of this specification.

3.9 Valve Installation

.1 Install valves on watermains and large diameter water services in accordance with manufacturer's instructions and SD-016. Valves are to be the same size as the watermain and water service unless shown otherwise on the Drawings.

.2 Install by-pass arrangement for valves 350 millimetres and larger in accordance with SD-017.

.3 Install valve box plumb, centred on valve with top of box at finished grade. Provide valve stem extension in valve box.

.4 Install new valves on existing watermains in accordance with methods in Section 3.8.6 of this specification.

.5 Orient valve box lids to close with the direction of traffic where installed in pavement.

.6 Install valves at locations and grades shown on the Drawings or as determined by the Contract Administrator in the field within a horizontal and vertical variance of +/- 100 millimetres.

3.10 Water Service Installation

.1 Install water services as specified for watermains in Section 3.3 and 3.4 of this specification.

.2 Install the curb stop so the operating key is inline with the water service when the curb stop is in the open position.

.3 Depth of water service from watermain to property line to be above combined sewers, wastewater sewers and sewer services where possible and be 2.3 to 2.75 metres deep.

.4 Locate curb stops for 19 to 50 millimetre diameter water services in street right-of-way 300 millimetres from property line in accordance with SD-012. Locate control valves for 150 millimetre and larger water services as follows.

.1 Regular water service: in street right-of-way 300 millimetres from property line.
.2 Fire protection service: within 1.0 metre of watermain.
.3 Combined regular water and fire protection service: within 1.0 metre of watermain.

.5 Couplings will not be permitted on new 19 to 38 millimetre diameter water service installations under 20 metres in length.

.6 Locate required water service pipe couplings outside of existing and future pavement limits unless approved otherwise by the Contract Administrator.

.7 Install approved curb stops and curb stop boxes on all new water services or where an existing curb stop is to be replaced.

.8 Install cast iron replacement curb stop boxes for existing 19 and 25 millimetre curb stops and cast iron valve box for existing 38 and 50 millimetre curb stops. Cut suitable slots in lower casing of valve box to allow box to be centred over curb stop and to not allow weight of curb box to be transferred to curb stop and water service pipe. Provide minimum 38 millimetre x 285 millimetre x 300 millimetre long pressure treated lumber base beneath curb stop to attach curb stop to and support curb stop box.

.9 Direct tap corporation stops into watermains except where connection clamps or tapping sleeves are indicated in Table 2110.1. Obtain the Contract Administrator's approval to use connection clamps as an alternate to direct tapping.

.10 Install 19 and 25 millimetre diameter corporation stops in top quadrant of watermain at an angle between 0^{o} and 30^{o} to horizontal. Install 38 and 50 millimetre corporation stops horizontally into watermain. Install corporation stops requiring connection clamps horizontally into watermain.

.11 Locate tap holes for corporation stops no closer than 600 millimetres from the end of an individual pipe length. Stagger multiple taps and separate by a minimum of 450 millimetres along pipe.

.12 Wrap threads of corporation stops with 3 to 4 layers of "Teflon" type pipe thread tape and tighten into watermains as follows leaving 1 to 3 threads showing.

.1 Asbestos-Cement, ductile and cast iron pipe: 70 to 80 Newton metres of torque.
.2 PVC pipe: 35 to 40 Newton metres of torque

.13 Cut copper water service pipe with a suitable tube cutter, flare end with appropriate flaring tool and connect to corporation stop and curb stop. Ensure ends of pipe are cut square and true with burrs removed before flaring. Tighten flare nut using suitable wrench. Pipe wrenches or other serrated jaw type wrenches will not be permitted. The following torque values are provided as a guide, check with manufacturer to confirm recommended tightening torque.

Water Service Size	Maximum Torque
19 millimetre	100 Newton meters
25 millimetres	100 Newton meters
38 millimetres	135 Newton meters
50 millimetres	170 Newton meters

.14 Form a combination vertical and horizontal gooseneck on 19 and 25 millimetre water service pipe adjacent to the corporation stop as shown on SD-012 without kinking and exceeding manufacturer's recommended maximum degree of curvature. Ensure top of gooseneck is a minimum 2.1 metres below

finished grade above the gooseneck.

TABLE CW 2110.1 - WATERMAIN TAPPING METHOD

WATERMAIN MATERIAL AND SIZE	WATER SERVICE SIZE			
	19 millimetre	25 millimetre	38 millimetre	50 millimetre
Asbestos-Cement				
100millimetre	CS	CS	NA	NA
150millimetre Class 150	CS	CS	CS	CS
150millimetre Class 200	CS	CS	CS	CS
200 to 400 millimetre	CS	CS	CS	CS
Ductile and Cast Iron				
100 millimetre	DT	DT	TS	TS
150 millimetre	DT	DT	CS	CS
200 to 500 millimetre	DT	DT	DT or CS	DT or CS
PVC (CI OD)				
150 to 300 millimetre	DT	DT	CS	CS
350 to 450 millimetre	CS	CS	CS	CS
PVC (IPS)				
150 to 300 millimetre	CS	CS	CS	CS

Legend
DT - Direct Tap
CS - Connection Saddle required
NA - Not Allowed
TS - Tapping Sleeve required
CI OD - Cast Iron Pipe Outside Diameter
IPS - Iron Pipe Size

3.11 Fitting and Thrust Block Installations

.1 Install fittings at locations and elevations shown on the Drawings, where required to connect to existing watermains and where directed by the Contract Administrator.

.2 Construct cast-in-place concrete thrust blocks for fittings in accordance with SD-004, SD-005 and as follows.

.1 Thrust block to bear against undisturbed soil.

.2 Cut soil to have a smooth vertical face and be at the proper angle to the fitting.

.3 Ensure horizontal struts or braces required for shoring are not located within limits of concrete thrust blocks.

.4 Install a minimum 0.15 millimetre (6 mil) thick polyethylene sheet bond breaker between cast iron fittings and concrete.

.3 Provide 24 hours notice to the Contract Administrator before concrete is placed to allow inspection and approval of thrust block formwork.

3.12 Watermain and Water Service Insulation

.1 Insulate watermains and water services in accordance with SD- 018 where cover to final grade will be less than 2.1 metres, at locations shown on the Drawings and where directed by the Contract Administrator.

3.13 Connecting to Existing Watermains and Large Diameter Water Services

.1 Where connecting to an existing watermain or large diameter water services requires removal of a plug in a fitting or end of pipe, connection will be considered an in-line connection – plug existing.

.2 Where connecting to an existing watermain or large diameter water service requires removal of a fitting or valve, connection will be considered an in-line connection – no plug existing.

.3 Where connecting to an existing watermain or large diameter water service requires installation of a tee, connection will be considered a perpendicular connection.

.4 Excavate and expose existing watermain or large diameter water service at locations shown on the Drawings or as directed by the Contract Administrator and remove existing fitting, valve, plug, concrete thrust block and required length of pipe to make the connection.

.5 Install a new gasket in the bell of the existing pipe or fitting.

.6 Cut the end of the existing pipe square to the axis of the pipe.

.7 Install required fittings, valves, new pipe, thrust blocks, couplings and other material necessary to make in-line or perpendicular connection.

.8 Use 150 x 150 x 150 millimetre tee with a 150 to 100 millimetre reducer when making perpendicular connection to an existing 100 millimetre watermain. Install reducer immediately adjacent to tee.

.9 Repair clamps will not be permitted for use as couplings when connecting to existing watermains.

.10 Repair existing watermains and large diameter water services as directed by the Contract Administrator that were damaged by carelessness during construction.

3.14 Connecting to Existing Watermains With Tapping Sleeve and Valve

.1 Excavate and expose the existing watermain at the location shown on the Drawings or where directed by the Contract Administrator.

.2 Remove all dirt, debris, rust and scale from the existing watermain pipe before installing tapping sleeve.

.3 Install tapping sleeve, drill hole of the required size in side of existing watermain and install tapping valve in accordance with the manufacturer's recommendations.

.4 Construct a concrete thrust block of the required size in accordance with SD-004 at tapping sleeve locations except for hydrant leads.

.5 Tapping sleeves and valves will not be permitted for use on 150 millimetre and smaller watermains and where the connecting pipe is less than 2 pipe sizes smaller than the existing watermain.

.6 Repair existing watermains as directed by the Contract Administrator that were damaged by carelessness during construction.

3.15 Connecting Existing Water Services to New Watermains

.1 Locate existing water service and cut or extend water service pipe as required to connect to new watermain.

.2 Connect required length of new 19 to 50 millimetre copper water service to existing water service pipe and corporation stop in new watermain in accordance with Section 3.10 of this specification.

.3 Connect required length of new 150 millimetre diameter and larger water services to existing water service and new watermain in accordance with Section 3.13 or 3.14 of this specification.

3.16 Plugging and Abandoning Watermains and Water Services

.1 Completely plug each end of watermain or large diameter water service sections that are to be cut-off and permanently abandoned with mortar or concrete.

.2 Fit end of watermain or large diameter water service to be left for a future connection with a cast iron plug or cap. Wrap end with minimum 0.15 millimetre (6 mil) polyethylene and construct a concrete thrust block of the required size in accordance with SD-004.

.3 Abandon existing large diameter water services on watermains in service as follows.

.1 Excavate to existing watermain and locate tee or tapping sleeve for service to be abandoned.

.2 Cut existing watermain pipe square to the pipe axis and remove existing tee or tapping sleeve and thrust block.

.3 Install new section of pipe in accordance with Section 3.3 of this specification and connect to existing watermain using approved couplings.

.4 Install a continuity bonding wire between ends of cast and ductile iron watermains that have been replaced with a length of PVC pipe. Prepare an area 50 millimetres square on the top of the pipe surface by grinding or filing to bare metal and attach the continuity bonding wire using the Thermite Welding process (Cadwelding).

.4 Abandon existing small diameter water services on watermains in service as follows.

.1 Excavate to existing watermain and locate corporation stop for service to be abandoned.

.2 Turn corporation stop to off position and cut water service pipe a maximum of 300 millimetres from the watermain. Crimp both ends of abandoned water service pipe flat.

.3 Remove service saddle if one is in place and install approved stainless steel repair clamp centered over hole in watermain in accordance with Clause 3.17.4 of this specification.

.4 Locate curb stop and remove top casing or cut-off casing a minimum of 900 millimetres below grade.

3.17 Repairs to Existing Watermains During Construction Activities

.1 Repair breaks that occur on existing watermains within and adjacent to the Site during construction of surface or underground works using an approved stainless steel repair clamp or by replacing the existing pipe with a length of PVC watermain pipe as directed by the Contract Administrator.

.2 The Contract Administrator will determine if a particular watermain break was due to carelessness or

other circumstances.

.3 Locate break and excavate to existing watermain in accordance with CW 2030.

.4 Remove dirt, debris, rust and scale from existing watermain and install repair clamp in accordance with manufacturer's recommendations

.5 Cut existing watermain pipe square to the pipe axis, remove required length of existing watermain pipe as directed by the Contract Administrator and install new watermain pipe in accordance with Section 3.3 of this Specification.

.6 Backfill as directed by the Contract Administrator in accordance with CW 2030 and SD-002.

.7 Install a continuity bonding wire between ends of cast and ductile iron watermains that have been repaired with a length of PVC pipe. Prepare an area 50 millimetres square on the top of the pipe surface by grinding or filing to bare metal and attach the continuity bonding wire using the Thermite Welding process (Cadwelding).

3.18 Installation of Sacrificial Zinc Anodes on Existing Metallic Watermains and Copper Services

.1 Install approved 10.9 kilogram sacrificial zinc anodes on existing metallic watermains, hydrant leads and large diameter water services whenever they are exposed and will remain in service after work is completed. Provide anodes as follows.

.1 One anode for every 3.0 metres of existing pipe exposed.

.2 One anode on existing pipe on either side of a new tee, cross or length of repair pipe.

.2 Install 10.9 kilogram sacrificial zinc anodes on copper watermains adjacent to water services as shown on SD-013.

.3 Install 10.9 kilogram sacrificial zinc anodes on copper water services as shown on SD-012 and as follows.

.1 Locate one anode adjacent to the curb stop and one anode adjacent to the corporation stop where the corporation stop is more than 4.5 metres away from the curb stop for new water service installation and for water service renewal from existing curb stop to existing watermain.

.2 Locate one anode adjacent to curb stop where new curb stop and curb stop box is installed on an existing copper water service.

.3 Locate one anode adjacent to corporation stop where an existing copper water service is reconnected to a new PVC watermain and the existing metallic watermain is removed.

.4 Install anodes as follows.

.1 Handle anode by the body only and do not lift by connecting wire.

.2 Remove plastic wrapping around anodes if provided. Do not remove cardboard packaging.

.3 Lay anode flat in bottom of excavation parallel to and at least 0.5 metres away from watermain or water service.

.4 Perforate the entire length of the top half of the cardboard packaging with a sufficient number of 12 millimetre diameter holes to allow water to soak into the conductive backfill within the packaging. Do

not allow the conductive backfill to spill out.

.5 Cover the anode with excavated material before installing bedding for watermain or water services.

.6 Wrap the anode connection wire 1½ times around the watermain or water service before attaching. Leave sufficient slack on anode connecting wire to prevent stain on wire from backfill.

.7 Prepare an area 50 millimetres square on the top of the pipe surface by grinding or filing to bare metal and attach the anode connecting wire using the Thermite Welding process (Cadwelding).

.8 Attach anode connecting wire to lugs on the corporation stop and curb stop where provided otherwise attach the anode connecting wire to the copper water service with an electrical copper alloy ground clamp.

.9 Place initial backfill in excavation taking care to not dislodge the anode connecting wire from the anode.

.10 Pour a minimum of 60 litres of potable water over backfill where anode is located after the watermain or water service is bedded and initially backfilled. Eliminate addition of water if backfill material is sufficiently wet.

3.19 Installation of Continuity Bonding Between Copper Water Services and Abandoned Watermains

.1 Provide continuity bonding between new and existing copper water services connected to a new PVC watermain and existing metallic watermains abandoned in place.

.2 Install the continuity bonding wire as follows.

.1 Attach one end of the continuity bonding wire to an electrical copper alloy ground clamp installed on the copper water service pipe near the corporation stop or to a grounding lug provided on approved corporation stops.

.2 Attach the other end of the continuity bonding wire to either an electrical copper alloy ground clamp installed on an abandoned copper water service pipe still connected to the abandoned metallic watermain or directly to the abandoned metallic watermain.

.3 Wrap the continuity bonding wire 1½ times around the copper water service and abandoned metallic watermain before attaching. Leave sufficient slack on continuity bonding wire to prevent strain on the wire from backfill.

.4 Prepare an area 50 millimetres square on the top of the abandoned watermain pipe surface by grinding or filing to bare metal and attach the continuity bonding wire using the Thermite Welding process (Cadwelding).

3.20 Removal and Abandonment of Existing Valves, Valve Boxes and Hydrants

.1 Remove existing valves by excavating to the existing watermain and removing, the valve, valve box and valve stem extension. Plug the ends of the watermain pipe in accordance with Section 3.16 of this specification.

.2 Abandon existing valves by removing the upper casing of the valve box and valve stem extension inside.

.3 Excavate and remove existing hydrant, hydrant valve and hydrant lead pipe from the hydrant tee on the watermain. Remove the existing hydrant tee on watermains remaining in service in accordance with Clause 3.16.3 of this specification. Plug hydrant drain pipe if one exists with mortar or concrete.

.4 Load and deliver salvaged valves, valve boxes, valve stem extensions and hydrants as directed by the Contract Administrator to the Water and Waste Department, Water Services Division Yard located at 552 Plinguet Street. Unload valves, valve boxes and hydrants at the yard as directed by City personnel.

3.21 Adjustment and Relocation of Existing Hydrants

.1 Raise existing hydrants as shown on the Drawings or identified in the Specifications or as directed by the Contract Administrator as follows.

.1 Obtain and follow hydrant manufacturer's instructions for extending hydrant.

.2 Remove the hydrant body and disconnect the existing stem coupling.

.3 Attach the required length of barrel extension, stem extension and stem coupling.

.4 Install new nuts, washers and bolts, a new gasket and breakaway flange on the barrel extension 50 millimetres to 150 millimetres above the final design elevation.

.2 Lower existing hydrants as shown on the Drawings or identified in the Specifications or as directed by the Contract Administrator as follows.

.1 Remove the existing hydrant, thrust block and hydrant lead pipe as required.

.2 Install a new hydrant with the appropriate depth of bury in accordance with Section 3.8 of this specification.

.3 Install required fittings, new hydrant lead pipe, thrust blocks, couplings and other material necessary to make the connection to the existing valve or lead pipe. Install new gaskets in bell ends of existing pipe or fittings.

.4 Disconnect and plug drain on hydrant if one exists. Plug end of hydrant drain pipe to sewer with mortar or cement.

.5 Adjust the existing hydrant valve box to the required finished grade.

.6 Load and deliver salvaged hydrants to the Water and Waste Department, Water Services Division Yard located at 552 Plinguet Street. Unload valves, valve boxes and hydrants at the yard as directed by City personnel.

.3 Relocate existing hydrants where shown on the Drawings or indicated in the Specifications or as directed by the Contract Administrator as follows.

.1 Type A Relocation – Using Existing Hydrant Tee and Extending Lead Pipe

.1 Excavate and remove the existing hydrant and hydrant valve from the hydrant lead pipe as shown on the Drawings and Specifications or as directed by the Contract Administrator. Replace broken or defective components as directed by the Contract Administrator.

.2 Install the existing hydrant at the location shown on the Drawings or indicated in the Specifications or as directed by the Contract Administrator in accordance with Section 3.8 of this specification.

.3 Install required fittings, new hydrant lead pipe, thrust blocks, couplings and other material necessary to make the connections. Install new gaskets in bell ends of existing pipe or fittings.

.4 Install hydrant lead pipe extension in accordance with Section 3.3 or 3.4 of this Specification.

.2 Type B Relocation – Abandoning Existing Hydrant Tee

.1 Excavate and remove the existing hydrant and hydrant valve from the hydrant lead pipe as shown on the Drawings and Specifications or as directed by the Contract Administrator. Replace broken or defective components as directed by the Contract Administrator.

.2 Abandon the existing hydrant tee by removing the tee in accordance with Clause 3.16.3 of this specification.

.3 Install the existing or new hydrant and hydrant valve at the location shown on the Drawings and Specifications or as directed by the Contract Administrator and in accordance with Clause 3.8 of this specification.

.4 Flush and disinfect adjusted and relocated hydrants and extended hydrant leads in accordance with CW 2125.

3.22 Exposing Existing Watermains and Sewer Services

.1 Expose existing watermains at proposed connection locations and other locations as directed by the Contract Administrator far enough in advance of watermain installation to allow existing watermain inverts to be determined. The Contract Administrator will modify design grades as required.

.2 Locate and expose existing sewer services far enough in advance of watermain installation to allow the Contract Administrator to determine if there is a conflict with the watermain grade. The Contract Administrator will modify watermain design grade or direct the sewer service to be to re-graded if there is a conflict.

.3 Replace sewer services removed to facilitate installation of watermain or that are damaged during excavation for the watermain installation.

3.23 Connecting to Existing Lead Water Services

.1 Connect new copper water service to existing lead water service with a suitable sized flanged copper to lead adapter. Conventional copper to copper flared and compression fittings will not be allowed. Connect to existing lead water services at the property line a distance of 300 millimetre beyond new curb stops.

3.24 Replacement of Private Lead Services

.1 Where it is determined a lead water service exists on private property, the Contract Administrator will provide the property owner with a notice of an opportunity to replace the lead water service in conjunction with watermain work in the vicinity.

.2 Maintain the excavation at the curb stop open for up to 5 working days to allow connection of new water service if owner decides to replace existing lead service on private property. Proceed with remainder of the Work to not conflict with replacement of lead water service on private property.

.3 Backfill the excavation after connection of the new water service or after 5 working days whichever occurs first unless directed otherwise by the Contract Administrator.

3.25 Temporary Pressurized Water Supply

.1 Provide and maintain a temporary pressurized water supply to residential, commercial and industrial customers in accordance with CW 1120 where existing watermains will be shutdown or interrupted during installation of new watermains.

.2 Locate temporary pressurized water supply lines where they will not interfere with or present a hazard to pedestrian and vehicle traffic or obstruct access to buildings and residences.

.3 Install temporary pressurized water supply beneath collector or regional streets and where directed by the Contract Administrator using trenchless methods.

.4 Connect temporary water service to the outside hose bib on building or residence or make arrangements with owner of building or resident for other connection location. Arrange with owner of building or resident to close the valve on the water service located by the water meter inside the building or residence.

.5 Chlorinate, disinfect and flush temporary pressurized water supply lines in accordance with CW 2125 before connecting to buildings and residences.

.6 Protect temporary pressurized water supply lines from freezing.

.7 Remove temporary pressurized water supply lines once new watermains have been accepted and put into service. Arrange with owner of building or resident to open the valve on the water service located by the water meter inside the building or residence. Remove sand and debris that may have entered the water meter during construction of the Work as directed by the Contract Administrator.

3.26 Hydrostatic Leakage Testing and Disinfection

.1 Perform hydrostatic leakage testing and disinfection of watermains and water services in accordance with CW 2125.

3.27 Boulevard and Pavement Restoration

.1 Replace concrete pavement slabs, miscellaneous concrete slabs, curbs and asphaltic pavement in accordance with CW3230, CW 3235, CW 3240 and CW 3410 as indicated in the Specifications and as directed by the Contract Administrator. Use “early opening” concrete in accordance with CW 3310 as indicated in the Specifications and as directed by the Contract Administrator.

.2 Restore boulevards and grassed areas by sodding or seeding using imported topsoil in accordance with CW 3510 and CW 3520 as indicated in the Specifications and as directed by the Contract Administrator.

.3 Restore gravel surfaces in accordance with CW 3150 as indicated in the Specifications and as directed by the Contract Administrator.

4. MEASUREMENT AND PAYMENT

4.1 Watermain Installation

.1 Watermain installation will be measured on a length basis for each size, method of installation, type of bedding and type of backfill and paid for at the Contract Unit Price per metre for “Watermains” or “Watermain Renewals”. Length to be paid for will be the total number of linear metres supplied and

installed in accordance with this specification, accepted and measured by the Contract Administrator.

.2 Measurement for length of watermain installed in a trench will be made horizontally at grade above the centreline of pipe through fittings.

.3 Measurement for length of watermain installed using trenchless methods will be made horizontally at grade above the centreline of pipe through shafts. Measurement where the type of backfill used in shafts changes will be from the midpoint distance between adjacent shafts.

.4 Extraction of existing pipe required to install new pipe will be included with payment for trenchless method of installation.

.5 Measurement for length of watermain installed using trenchless methods between watermains installed in a trench will be made horizontally at grade above the centreline of pipe from face to face of the trench excavation.

.6 Watermains specified to be installed using trenchless methods but were installed in a trench due to field conditions will be paid for at the Contract Unit Price per metre for trenchless installation.

.7 Measurement for length of watermain installed in a casing pipe will be made horizontally at grade above the centreline of pipe for the length of the casing pipe.

.8 Supply and installation of watermain casing pipe will be included with installation of watermain or watermain renewal.

.9 Repair of damage to underground and surface structures due to surface subsidence and soil heaving caused by trenchless installation methods will be at own expense.

.10 Correction of alignment and grade exceeding the allowable variance will be at own expense.

4.2 Extraction of Existing Watermains to be Abandoned

.1 Extraction of existing watermains to be abandoned will be measured on a length basis for each size extracted and paid for at the Contract Unit Price per metre for “Extraction of Existing Watermains to be Abandoned”. Length to be paid for will be the total number of linear metres extracted in accordance with this specification, accepted and measured by the Contract Administrator.

.2 Measurement for length of existing abandoned watermains removed by extraction will be made from face to face of shafts.

4.3 Hydrant Assembly Installation

.1 Hydrant assembly installation will be measured on a unit basis for each type and paid for at the Contract Unit Price for “Hydrant Assembly” and “New Hydrant Assembly on Existing Watermain”. Number of units to be paid for will be the total number of hydrant assemblies supplied and installed in accordance with this specification, accepted and measured by the Contract Administrator.

.2 Construction of concrete thrust blocks and installation of mechanical restrainers will be included with installation of the hydrant assembly.

.3 Extensions or adjustments necessary to locate hydrant flange at required finished elevation will be included with the hydrant assembly.

.4 Up to 3.0 metres of hydrant lead pipe measured from the connection to the hydrant tee on the watermain will be included with the hydrant assembly.

.5 Hydrant lead pipe longer than 3.0 metres will be measured for payment in accordance with Section 4.1 of this specification.

.6 PVC pipe and couplings required to connect a new hydrant assembly to an existing watermain will be included with the hydrant assembly installation.

4.4 Valve Installation

.1 Valve installation will be measured on a unit basis for each size and type and paid for at the Contract Unit Price for "Watermain Valve" and "New Watermain Valve on Existing Watermain". Number of units to be paid for will be the total number of watermain valves supplied and installed in accordance with this specification, accepted and measured by the Contract Administrator.

.2 PVC pipe and couplings required to install a new valve on an existing watermain will be included with the valve installation.

4.5 Water Service Installation

.1 Water service installation will be measured on a length basis for each size, method of installation, type of bedding and type of backfill and paid for at the Contract Unit Price per metre for "Water Services". Length to be paid for will be the total number of linear metres supplied and installed in accordance with this specification, accepted and measured by the Contract Administrator.

.2 Measurement for length of water services installed in a trench will be made horizontally at grade, above the centreline of pipe through fittings from the connection at the watermain to the specified termination point of the water service.

.3 Measurement for length of water services installed using trenchless methods will be made horizontally at grade above the centreline of pipe through shafts from the connection at the watermain to the specified termination point of the water service.

.4 Measurement for length of water services installed using trenchless methods between water services installed in a trench will be made horizontally at grade above the centreline of pipe from face to face of the trench excavation.

.5 Water services specified to be installed using trenchless methods but were installed in a trench due to field conditions will be paid for at the Contract Unit Price per metre for trenchless installation.

4.6 Corporation Stops

.1 Corporation stops will be measured on a unit basis for each size and paid for at the Contract Unit Price for "Corporation Stops". Number of units to be paid for will be the total number of corporation stops supplied and installed in accordance with this specification, accepted and measured by the Contract Administrator.

4.7 Curb Stops

.1 Curb stops will be measured on a unit basis for each size and paid for at the Contract Unit Price for "Curb Stops" or "Curb Stops – Replace Existing". Number of units to be paid for will be the total number of curb stops supplied and installed in accordance with this specification, accepted and measured by the Contract Administrator.

4.8 Curb Stop Boxes

.1 Curb stop boxes will be measured on a unit basis for each size and paid for at the Contract Unit Price for "Curb Stop Boxes" or "Curb Stop Boxes – Replace Existing". Number of units to be paid for will be the total number of curb stop boxes supplied and installed in accordance with this specification accepted and measured by the Contract Administrator.

4.9 Fitting and Thrust Block Installation

.1 Fittings on watermains and large diameter water services except tees for hydrant assemblies, will be measured on a unit basis for each type and size and paid for at the Contract Unit Price for "Fittings". Number of units to be paid for will be the total number of fittings supplied and installed in accordance with this specification, accepted and measured by the Contract Administrator.

.2 Construction of concrete thrust blocks and installation of mechanical restrainers and joint harnesses will be included with installation of fittings.

4.10 Watermain and Water Service Insulation

.1 Watermain and water service insulation will be measured on a length basis and paid for at the Contract Unit Price for "Watermain and Water Service Insulation". Length to be paid for will be the total length of watermain and water service insulation supplied and installed in accordance with this specification, accepted and measured by the Contract Administrator.

.2 Measurement of watermain and water service insulation will be made horizontally at grade along the centreline of the insulation.

4.11 Connecting to Existing Watermains and Large Diameter Water Services

.1 Connecting to existing watermains and large diameter water services will be measured on a unit basis for each type and size and paid for at the Contract Unit Price for the Items of Work listed. Number of units to be paid for will be the total number of connections made in accordance with this specification, accepted and measured by the Contract Administrator.

Items of Work:

Connecting to Existing Watermains and Large Diameter Water Services

i.) Inline Connection - Plug Existing
ii.) Inline Connection - No Plug Existing
iii.) Perpendicular Connection

.2 Supply and installation of fittings except couplings will be measured for payment in accordance with Section 4.9 of this specification.

.3 Supply and installation of couplings will be included with the connection.

.4 Supply and installation of up to 1.0 metre of watermain pipe on each side of the new tee installed for a perpendicular connection measured from the centerline of the tee will be included with the connection.

.5 Supply and installation of watermain or large diameter water service longer than 1.0 metres will be measured for payment in accordance with Section 4.1 of this specification.

4.12 Connecting to Existing Watermains With Tapping Sleeve and Valve

.1 Connecting to existing watermains with a tapping sleeve and valve will be measured on a unit basis for each size and paid for at the Contract Unit Price for "Connecting to Existing Watermains With Tapping Sleeve and Valve". Number of units to be paid for will be the total number of units supplied and installed in accordance with this specification, acceptable to and measured by the Contract Administrator.

4.13 Connecting Existing Copper Water Services to New Watermain

.1 Connecting existing 20 to 50 millimetre copper water services to new watermains will be measured on a unit basis for each size and paid for at the Contract Unit Price for "Connecting Existing Copper Water Services to New Watermains". Number of units to be paid for will be the total number of units supplied and installed in accordance with this specification, accepted and measured by Contract Administrator.

.2 Supply and installation of couplings and up to 1.0 metre of new copper water service pipe measured from the outside of the new watermain will be included in the connection.

.3 Supply and installation of copper water service pipe longer than 1.0 metres will be measured and paid for in accordance with Section 4.5 of this specification.

4.14 Plugging and Abandoning Watermains and Water Services

.1 Cutting off, plugging and abandoning of watermains and large diameter water services will be included with watermain work.

.2 Abandoning existing large diameter water services on watermains in service will be measured on a unit basis for each size of water service abandoned and paid for at the Contract Unit Price for "Abandoning Large Diameter Water Services". Number of units to be paid for will be total number of large diameter water services abandoned in accordance with this specification, accepted and measured by the Contract Administrator.

.3 Abandoning existing small diameter water services on watermains in service will be measured on a unit basis for each size of water service abandoned and paid for at the Contract Unit Price for "Abandoning Small Diameter Water Services". Number of units to be paid for will be total number of small diameter water services abandoned in accordance with this specification, accepted and measured by the Contract Administrator.

4.15 Repairs to Existing Watermains

.1 Repairs made to existing watermains using stainless steel repair clamps will be measured on a unit basis for each size, length of clamp and type of backfill and paid for at the Contract Unit Price for "Watermain Repair - Repair Clamp". Number of units to be paid for will be total number of repair clamps supplied and installed in accordance with this specification, accepted and measured by the Contract Administrator.

.2 Repairs made to existing watermains by replacing up to 3.0 continuous metres of pipe will be measured for payment on a unit basis for each size and type of backfill and paid for at the Contract Unit Price for "Watermain Repair – Up to 3.0 Metres Long". Number of units to be paid for will be the total number of watermain repairs up to 3.0 metres long supplied and installed in accordance with this specification, accepted and measured by the Contract Administrator.

.3 Repairs made to existing watermains by replacing additional pipe continuous to the first 3.0 metres of pipe will be measured for payment on a length basis for each size and type of backfill and paid for at the Contract Unit Price for "Watermain Repair – In Addition to First 3.0 metres". Length to be paid for will be the total number of linear metres of watermain repair additional to the first 3.0 metre repair supplied and

installed in accordance with this specification, accepted and measured by the Contract Administrator.

.4 Repairs to existing watermains damaged by carelessness as determined by the Contract Administrator will be at own expense.

.5 Supply and installation of continuity bonding wire will be included with watermain repairs.

4.16 Sacrificial Zinc Anodes

.1 Sacrificial zinc anodes installed on existing metallic watermains and copper water services will be measured on a unit basis and paid for at the Contract Unit Price for "10.9 Kilogram Sacrificial Zinc Anodes" for the Items of Work listed on the Schedule of Prices. Number of units to be paid for will be the total number of anodes supplied and installed in accordance with this specification, accepted and measured by the Contract Administrator.

Items of Work:

10.9 Kilogram Sacrificial Zinc Anodes
- i.) On Metallic Watermains
- ii.) On 38 Copper Watermains
- iii.) On Water Services

4.17 Continuity Bonding Wire Between Copper Water Services and Abandoned Watermains

.1 Continuity bonding wire installed between copper water services and abandoned metallic watermains will be measured on a unit basis and paid for at the Contract Unit Price for "Continuity Bonding". Number of units to be paid for will be the total number of continuity bonding wires supplied and installed in accordance with this specification, accepted and measured by the Contract Administrator.

4.18 Removal and Abandonment of Existing Valves, Valve Boxes and Hydrant Assemblies

.1 Removal and abandonment of existing valves, valve boxes and hydrant assemblies on watermains that will be abandoned will be included with installation of watermains and watermain renewals.

.2 Abandonment of hydrant tees on watermains that will remain in service will be measured on a unit basis for "Abandonment of Hydrant Tees on Watermains in Service". The number to be paid for will be the total number of hydrant tees abandoned in accordance with this Specification, accepted and measured by the Contract Administrator.

.3 Repair or replace valves and hydrants identified by the Contract Administrator to be salvaged that are not delivered to or are damaged by carelessness before or while being delivered to the Water Services' Yards will be at own expense.

4.19 Adjustment and Relocation of Existing Hydrants

.1 Adjustment of existing hydrants by raising will be measured on a unit basis for "Raising Existing Hydrant". The number to be paid for will be the total number of raised hydrants made in accordance with this Specification, accepted and measured by the Contract Administrator.

.2 Adjustment of hydrants by removing and lowering will be measured on a unit basis for "Removing and Lowering Existing Hydrant". The number to be paid for will be the total number of raised hydrants made in accordance with this Specification, accepted and measured by the Contract Administrator.

.3 Delivery of salvaged hydrants to the specified location will be included with hydrant adjustment.

.2 Relocating existing hydrants will be measured on a unit basis and paid for at the Contract Unit Price for "Relocating Existing Hydrant – Type A or Type B". Number of units to be paid for will be the total number of hydrants relocated in accordance with this specification, accepted and measured by the Contract Administrator.

.3 Up to 3.0 metres of new hydrant lead pipe measured from the connection to the existing hydrant lead will be included with "Relocating Existing Hydrant".

.4 New hydrant lead pipe longer than 3.0 metres will be measured for payment in accordance with Section 4.1 of this specification.

4.20 Exposing Existing Watermains and Sewer Services

.1 Exposing existing watermains and sewer services to determine elevations will be included with installation of watermains and watermain renewals.

.2 Sewer services removed and replaced to facilitate installation of watermains or watermain renewals or that are repaired or replaced due to carelessness during construction will be at own expense.

4.21 Regrading of Existing Sewer Services

.1 Regrading of sewer services up to 1.5 metres in length will be measured for payment on a unit basis for each size of service and paid for at the Contract Unit Price for "Regrading Existing Sewer Service – Up to 1.5 Metres Long". Number of units to be paid for will be the total number of sewer services regraded in accordance with this specification, accepted and measured by the Contract Administrator.

.2 Regrading of sewer services longer than 1.5 metres will be measured for payment on a length basis for each size of service and paid for at the Contract Unit Price for "Regrading Existing Sewer Services – Longer Than 1.5 metres". Length to be paid for will be the total length of sewer services regraded in accordance with this specification, accepted and measured by the Contract Administrator.

.3 Measurement will be made horizontally at grade above the centreline of the sewer service through fittings from connection to connection to the existing sewer service.

.4 Supply and installation of couplings and connections to existing sewer service will be included in regrading of sewer service.

4.22 Connecting to Existing Lead Water Services

.1 Connecting to existing lead water services will be included in replacement of water service and curb stop.

4.23 Maintaining Curb Stop Excavations for Replacement of Private Lead Services

.1 Maintaining curb stop excavations for replacement of private lead services by others will be measured on a unit basis per working day per excavation and paid for at the Contract Unit price for "Maintaining Curb Stop Excavations". Number of units to be paid for will be total number of excavations per working day that are maintained in accordance with this specification, accepted and measured by the Contract Administrator.

4.24 Temporary Pressurized Water Supply

.1 Provision of temporary pressurized water supply where existing watermains are shutdown or interrupted will be included with the watermain work being done.

4.25 Pavement Restoration

.1 Renewal of existing concrete pavement slabs will be measured on a surface area basis per square metre in accordance with CW 3230. No separate measurement or payment will be made for Drilled Dowels or Tie Bars, the cost for which shall be included in the prices bid for renewal of concrete pavement slabs.

.2 Removal and replacement of existing miscellaneous concrete slabs, curbs and asphaltic pavement will be measured for payment in accordance with CW 3235, CW 3240 and CW 3410.

4.26 Boulevard Restoration

.1 Restoration of boulevards and grassed areas disturbed due to construction activities will be included with watermain work being done.

.2 Restoration of boulevard and grassed areas beyond the limits of construction as directed by the Contract Administrator will be measured for payment in accordance with CW 3510 and CW 3520.

CW 2130 - GRAVITY SEWERS

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CW 2130 - GRAVITY SEWERS

1. DESCRIPTION

1.1 General

.1 This specification covers supply and installation of combined sewers, interceptor sewers, land drainage sewers, storm relief sewers, wastewater sewers, sewer services, sewer repairs, catch basins, manholes and connections to existing catch basins, manholes and sewers including fittings, appurtenances and related work.

1.2 Definitions

.1 Fittings include tees, wyes, bends, reducers, couplings and plugs.

.2 Appurtenances include, flexible rubber compression joint sealers, bushings, catch basin hoods, hooks and pins, fasteners and miscellaneous components required for completion of the Work.

.3 Where used in this specification “sewer services” will include sewer connections as defined in the City of Winnipeg By-Law No. 7070 as well as catch basin leads, roof drains and utility manhole drains.

.4 Sewer service risers consist of that portion of the sewer service from the outside top of the sewer pipe to the top of the sewer service pipe at the 45 degree elbow as shown on SD-014 and SD-015.

.5 Trenchless installation methods are methods of installing pipe inside a hole that has been made between shafts by coring, boring, horizontal directional drilling, jacking, tunnelling and extraction of an existing pipe or similar methods with minimal excavation and surface disruption.

1.3 Referenced Standard Construction Specifications

.1 CW 2030 - Excavation, Bedding and Backfill
.2 CW 2140 – Sewer And Manhole Cleaning
.3 CW 2145 – Sewer and Manhole Inspections
.4 CW 2160 - Concrete Underground Structures and Works
.5 CW 3110 - Sub-Grade, Sub-base and Base Course Construction
.6 CW 3150 – Gravel Surfacing
.7 CW 3210 – Adjustment of Pavement and Boulevard Structures
.8 CW 3230 -Full-Depth Patching of Existing Slabs and Joints
.9 CW 3235 - Renewal of Existing Miscellaneous Concrete Slabs
.10 CW 3240 - Renewal of Existing Curbs
.11 CW 3310 – Portland Cement Concrete Pavement Works
.12 CW 3410 - Asphalt Concrete Pavement Works
.13 CW 3510 - Sodding
.14 CW 3520 - Seeding

1.4 Referenced Standard Details

.1 SD-001 - Standard Pipe Bedding Classes
.2 SD-002 - Standard Trench and Excavation Backfill Classes
.3 SD-009 – Sewer or Sewer Service Connection to Existing 1050 Diameter and Larger Sewer
.4 SD-010 - Standard Pre-cast Concrete Manhole (For up to 525 Millimetre Pipe)
.5 SD-011 - Standard Pre-cast Concrete Pipe Manhole (For 600 to 1500 Diameter Pipe)

.6 SD-014 - Sewer Service With Alternative “A” Riser
.7 SD-015 - Sewer Service With Alternate “B” Riser
.8 SD-020 – Nine Arm Mandrel and Proving Ring for 5.25% Deflection Testing of SDR 35 PVC Pipe
.9 SD-021 – Sewer Service Abandonment Beneath Pavement
.10 SD-022A – Sewer Repair Up to 3.0 Metres Long
.11 SD-022B – Sewer Repair Longer Than 3.0 Metres
.12 SD-023 - Curb and Gutter Inlet With Catch Pit
.13 SD-024 - Catch Basin With Curb and Gutter Inlet
.14 SD-025 - Standard Catch Basin
.15 SD-220B – Manhole Isolation Detail in Existing Pavements
.16 SD-220C – Curb and Gutter Inlet Isolation Detail

1.5 Referenced Approved Product Drawings

.1 AP-004 - Standard Frame for Manhole and Catch Basin
.2 AP-005 - Standard Solid Cover for Standard Frame
.3 AP-006 - Standard Grated Cover for Standard Frame
.4 AP-007 – Lifter Ring for Standard Frame
.5 AP-008 – Barrier Curb and Gutter Inlet Frame and Box
.6 AP-009 – Barrier Curb and Gutter Inlet Cover
.7 AP-011 – Mountable Curb and Gutter Inlet
.8 AP-012 - Catch Basin Hood

2. MATERIALS

2.1 Approved Products

.1 Use only those products listed as Approved Products for Underground Use in the City of Winnipeg found on the City of Winnipeg, Materials Management web site at: http://www.winnipeg.ca/matmgt/spec/

2.2 Sewer and Sewer Service Pipe

.1 Mainline and sewer connection pipe to be in accordance with AT 4.2.1.10 and AT 4.2.2.10 of the Approved Products for Underground Use in the City of Winnipeg.

.2 Mainline cul-de-sac sewer pipe to be in accordance with AT 4.2.1.11.

.3 Open profile ribbed storm sewer pipe in accordance with AT 4.2.1.16 of the Approved Products for Underground Use in the City of Winnipeg.

.4 250 to 600 millimetre non-reinforced concrete bell and spigot pipe in accordance with CAN/CSA A257.1 and ASTM C14, Class 3.

.5 300 millimetre and larger reinforced concrete bell and spigot pipe in accordance with CAN/CSA A257.2 and ASTM C76.

.6 Reinforced concrete bell and spigot straight wall pipe used for jacking in accordance with CAN/CSA A257.2 and ASTM C76. Outside of bell ends to be fitted with a 14 gauge steel band with a width of 1.5 times the length of the bell end groove.

2.3 Drainage Inlet Connection Pipe

.1 250 millimetre diameter gasketed bell and spigot PVC pipe in accordance with CAN/CSA B182.2 and ASTM D 3034, SDR 35.

.2 250 millimetre non-reinforced concrete bell and spigot pipe in accordance with CAN/CSA A257.1 and ASTM C14, Class 3.

2.4 Sewer and Sewer Service Fittings and Connection Saddles

.1 150 millimetre and larger gasketed push-on style PVC injection moulded fittings in accordance with AT 4.2.1.60 of the Approved Products for Underground Use in the City of Winnipeg.

.2 450 millimetre and larger gasketed push-on style PVC fabricated fittings in accordance with AT 4.2.1.61 of the Approved Products for Underground Use in the City of Winnipeg.

.3 250 millimetre and larger gasketed bell and spigot concrete pipe fittings in accordance with CAN/CSA A257 Series and ASTM C 14 and C 76.

2.5 Sewer Pipe Gaskets

.1 PVC pipe gaskets, flexible rubber in accordance with ASTM F477

.2 Concrete pipe gaskets, flexible rubber in accordance with ASTM C443.

.3 Where required, elastomeric compounds for oil and gas resistant gaskets to be rated as "excellent".

2.6 Flexible Transition Pipe Couplings

.1 Flexible transition sewer couplings to be in accordance with AT 4.2.1.66 of the Approved Products for Underground Use in the City of Winnipeg.

2.7 Manholes,Catch Basins and Catch Pits

.1 Pre-cast concrete sections as indicated on SD-010, SD-011, SD-023, SD-024 and SD-025: to CSA A257.4 and ASTM Standard C 76 Class II and C 478 (circular sections)

.2 Cast iron frames and covers to be in accordance with AP-004, AP-005, AP-006, AP-007, AP-008, AP-009, AP-010 and AP-011 in accordance with AT 4.2.1.73, AT 4.2.1.75, AT 4.2.1.83B, and AT 4.2.1.83M of the Approved Products for Underground Use in the City of Winnipeg.

.3 Ladder rungs to be in accordance with AT 4.2.1.72 of the Approved Products for Underground Use in the City of Winnipeg.

.4 Pre-cast concrete adjusting rings in accordance with CAN/CSA A257.4 and ASTM C478.

.5 Concrete brick in accordance with CAN3-A165 Series.

.6 Catch basin hood to be in accordance with AP-012 and AT 4.2.1.84 of the Approved Products for Underground Use in the City of Winnipeg.

.7 Manhole and catchbasin joint gaskets to be in accordance with AT 4.2.1.71 of the Approved Products for Underground Use in the City of Winnipeg.

.8 Core and seat boot type flexible rubber connection for PVC pipe in accordance with material requirements of ASTM C923.

2.8 Fasteners

.1 Fasteners, tie rods, clamps, straps, bands, nuts and bolts to be stainless steel in accordance with ASTM A320, ANSI Type 316 marked as such with raised or indented numerals.

2.9 Cast-in-Place Concrete, Grout, Mortar and Cement-Stabilized Fill

.1 Cast-in-place concrete, grout, mortar and cement stabilized fill in accordance with CW 2160.

2.10 Cement Patching Compound

.1 Cement patching compound to be fast hardening, high strength non-shrink mixture suitable for use on vertical surfaces.

2.11 Bedding and Backfill

.1 Bedding and backfill in accordance with CW 2030.

3. CONSTRUCTION METHODS

3.1 Excavation

.1 Remove existing concrete pavement slabs, miscellaneous concrete slabs, curbs and asphalt pavement in accordance with CW 3110, CW3230, CW 3235, CW 3240 and CW 3410.

.2 Excavate in accordance with CW 2030. Excavate and prepare trench a sufficient distance in ahead to not to interfere with installation of the pipe.

3.2 Foundation and Bedding

.1 Place and compact foundation material, where required and bedding material in bottom of trench or excavation in accordance with CW 2030 and SD-001 to grade and elevation shown on the Drawings. Level across full width of trench or excavation and leave ready for pipe installation.

3.3 Installation in a Trench

.1 Install same material, class and type of pipe between adjacent manholes.

.2 Assemble pipe in accordance with manufacturer's instructions so when complete sewer will have a smooth and uniform invert. Lay pipe with bell upgrade. Use longest pipe size manufactured where practicable to reduce total number of joints on sewer.

.3 Place pipe on compacted bedding ensuring uniform support under bell and pipe body throughout its full length. Work and compact bedding material under sides of pipe to provide proper haunching.

.4 Protect exposed pipe ends with an approved stopper to prevent excess amounts of water, earth and debris from entering pipe as work proceeds.

.5 Install pipe to the line and grade shown on the Drawings or as determined by the Contract Administrator on-site in accordance with the limits in Section 3.6 of this specification.

.6 Pipe joint deflections to be within the manufacturer's recommendations.

.7 Remove construction debris and materials from sewers before performing video inspection.

3.4 Installation Using Trenchless Methods

.1 Install sewers using trenchless methods where alignment is under or crosses existing and proposed pavements, existing boulevards, trees, utility poles, structures and at other locations in accordance with the Drawings and Specifications or as directed by the Contract Administrator.

.2 Install same material, class and type of pipe between adjacent manholes.

.3 Excavate shafts and provide shoring in accordance with CW 2030.

.4 Provide the locations and sizes of shafts to the Contract Administrator for review before excavating.

.5 Completely remove existing pipe for on-line sewer renewals.

.6 Join pipe sections together in shafts before inserting into installation hole. Pull or push entire length of pipe into installation hole from end of last pipe with bells facing away from pulling or pushing direction. Installation methods where tension is applied to a pipe section will not be permitted.

.7 Ensure the force applied to the section of pipe being pulled or pushed into the installation hole does not result in spigots being inserted into the bell beyond the manufacturer's recommended insertion depth.

.8 Pull back the entire length of pipe already in the installation hole if a length of pipe is to be withdrawn from the installation hole.

.9 Install pipe to the line and grade shown on the Drawings or as determined by the Contract Administrator on-site in accordance with the limits in Section 3.6 of this specification.

.10 Keep pipe joint deflections within the manufacturer's recommendations.

.11 Remove construction debris and materials from sewers before performing video inspection.

.12 Repair damage to underground and surface structures due to surface subsidence and soil heaving caused by trenchless installation methods.

.13 Where field conditions are such that sewers cannot be installed using trenchless methods install sewers in a trench using the type of backfill specified in CW 2030 for the installation location after receiving written approval from the Contract Administrator.

3.5 Fitting Installation

.1 Install fittings of same material, type and class as sewer, sewer service or catch pit pipe.

.2 Install watertight plug in the end of sewers where shown on the Drawings to allow for a future connection.

.3 Excavate, bed and install fittings as specified for sewers and sewer services.

3.6 Line and Grade

.1 Allowable variance from specified line to be +/- 100 millimetres. Allowable variance from specified grade to be 25 millimetres above grade and 50 millimetres below grade at any one location. Allowable ponding in pipe due to combined variance above and below grade not to exceed 50 millimetres.

.2 Correct alignment and grade exceeding the allowable variance in a manner acceptable to the Contract Administrator.

3.7 Backfill

.1 Place and compact initial backfill above the pipe in accordance with CW 2030 and SD-001.

.2 Backfill the reminder of the trench or excavation in accordance with CW 2030 and SD-002.

3.8 Manhole, Catch Basin and Catch Pit Installation

.1 Level bedding to ensure manhole base, catch basin and catch pit is uniformly supported and the floor is level.

.2 Construct manholes, catch basins and catch pits in accordance with SD-010, SD-010D, SD-011, SD-023, SD-024 and SD-025 and as shown on the Drawings. Install manhole, drop pipe, catch basin and catch pit sections plumb and level. Variance from line and grade to be in accordance with Section 3.6 of this specification.

.3 Install approved gasket or joint sealer between pre-cast concrete sections including 750 millimetre diameter riser adjusting rings and between frame and pre-cast concrete riser as construction progresses. Alternately install grout between frame and pre-cast concrete risers as approved and directed by Contract Administrator. Ensure grout completely fills space between frame and riser to make joint watertight and finish flush with inside surface of risers.

.4 Connect sewers to manhole bases, catch basins and catch pits at invert elevations shown on the Drawings and grout in place to make a watertight connection. Coat outside of PVC pipe end for a length equal to the manhole, catch basin and catch pit wall thickness plus 150 millimetres with an approved cementing agent to which sand has been added and allow mixture to harden before grouting in place. Alternatively PVC pipe may be connected using an approved pre-treated, gasketed PVC insert or an approved interference fit flexible rubber boot or gasket inserted into a hole cored in the manhole base, catch basin or catch pit wall.

.5 Bench and channel manhole floor with mortar or concrete in accordance with SD-010 and SD-011 and as shown on the Drawings. Curve flow channels smoothly and provide smooth transition between inlet and outlet pipes.

.6 Grout and plug lifting holes, joints and frame with mortar to make watertight. Remove excess mortar from inside surface of manhole.

.7 Compact backfill between manholes, catch basins or catch pits and the sides of the trench or excavation in accordance with CW 2030.

3.9 New Manhole Installation on Existing Sewer

.1 Where a new manhole is to be installed by removing a length of the existing sewer pipe install the manhole in accordance with Section 3.8 of this specification and the following requirements.

.1 Cut fully through the existing sewer pipe leaving neat, square ends and remove the required length or remove existing sewer pipe at a joint within the excavation.

.2 Excavate the required depth below the existing sewer for granular foundation and bedding.

.3 Install required length of new sewer, connect to existing sewer with approved coupling, adapter or bushing and connect to new manhole.

.4 Remove construction debris and materials from manholes and sewers when the Work is complete.

.2 Where a new manhole is to be installed overtop the existing sewer without removing a length of pipe install the manhole in accordance with Section 3.8 of this specification and the following requirements.

.1 Excavate the required depth below the existing sewer for the cast-in-place concrete manhole floor. Fully support the existing sewer during excavation.

.2 Set the saddle or arch type open manhole base over the existing sewer in a manner to not damage the existing sewer.

.3 Place concrete in the bottom of the excavation and embed the manhole base to required elevation. Plumb and level the manhole base as required.

.4 Cut out and remove top portion of existing sewer as required in a manner that will not damage the remaining sewer pipe.

.5 Grout around the sewer pipe and manhole wall opening with mortar to make a watertight joint.

.6 Place mortar or concrete between the existing sewer pipe and the inside of new manhole wall and form smooth flow channel and benching.

.7 Remove construction debris and materials from manholes and sewers when the Work is complete.

3.10 Sewer Service Installation

1. Install sewer services as specified for sewers in accordance with Section 3.3 and 3.4 of this specification.

.2 Variance from specified line not to exceed +/- 100 millimetres. Variance from specified grade not to exceed +/- 25 millimetres.

.3 Connect sewer services to sewers at locations where preformed fittings have been provided. Use an approved adapter, coupling or bushing if required to make a watertight connection. Connect sewer services in accordance with Section 3.16 of this specification if preformed fittings do not exist on the sewer.

.4 Install a sewer service riser pipe in accordance with SD-014 and SD-015 where the connection to the sewer is deeper than 4.25 metres. Terminate sewer service riser 3.35 to 4.25 metres below finished grade.

.5 Use 45 degree or less bends only on sewer services.

.6 Install a watertight removable plug in the end of the sewer service to allow for a future connection.

3.11 Drainage Connection Pipe Installation

1. Install drainage connection pipe between inlet box or catch pit and catch basin in accordance with Section 3.3 and 3.4 of this specification at locations shown on the drawings or as directed by the Contact Administrator.

.2 Variance from specified line not to exceed +/- 100 millimetres. Variance from specified grade not to exceed +/- 25 millimetres.

.3 Connect drainage connecting pipe to existing catch basins in accordance with Section 3.8 of this specification.

3.12 Sewer Repairs

.1 Perform video inspection of sewer to be repaired using video equipment in accordance with CW 2145 and review with Contract Administrator to confirm repair limits. Coding of the video inspection is not required.

.2 Install required length of new sewer pipe in accordance with SD-022A or SD-022B, Section 3.3 or 3.4 of this specification and to the following requirements.

.1 Excavate, expose and remove sewer pipe to be repaired. Cut fully through existing sewer pipe at limits of repair leaving neat square ends or remove existing sewer pipe at a joint location within excavation.

.2 Install required length of sewer pipe of the type and class in accordance with the Specifications and Drawings.

.3 Connect new sewer pipe to existing sewer pipe using an approved flexible transition coupling, adapter or bushing to make a watertight connection.

.4 Connect new sewer pipe to existing manhole in accordance with Section 3.8.4 of this specification.

.3 Remove construction debris and materials from sewers when the Work is complete.

3.13 Existing Manhole and Catch Basin Repairs

.1 Saw cut and remove existing pavement in accordance with SD-220B and SD-220C where frames, covers, reducers and risers are required to be replaced.

.2 Prevent construction materials and debris from entering the sewer.

.3 Remove existing pre-cast concrete, cast-in-place concrete or brick reducer and riser sections to depth shown on the Drawings or as directed by the Contract Administrator without damaging

remaining risers. Level top of remaining riser section as necessary with mortar or concrete to accept and make a watertight joint with new pre-cast concrete flat top reducer or riser section. Add or remove excess mortar or concrete from joint as necessary to make new flat top reducer and riser section level and plumb and finish joint flush with inside surface of wall.

.4 Install pre-cast concrete riser sections, flat top reducer, frame and cover in accordance with Section 3.8 of this specification.

.5 Make final adjustment of frames in accordance with Section 3.2 of CW 3210.

.6 Remove loose and unsound material from inside surface of wall area to be repaired. Clean and prepare repair area as required and apply approved concrete patching compound in accordance with manufacturer's instructions. Finish surface smooth and form to shape of wall.

.7 Remove loose and flaking mortar from brickwork and clean repair area as required. Remove and replace cracked and broken bricks as necessary. Apply mortar to replacement brick before fitting into place. Work mortar completely into joints ensuring all gaps are filled. Remove excess mortar and shape joint to match existing.

.8 Cut existing rungs and steps to be replaced flush with inside wall surface. Install approved rungs on alignment indicated on contract drawings and as directed by the Contract Administrator at 300 millimetres vertically on centre.

.9 Cut existing catch basin hood wall hook to be replaced flush with inside wall surface. Attach approved wall hook directly above existing wall hook with adequately sized stainless steel anchor bolt. Replace broken or missing hinge pin with approved hinge pin.

.10 Remove construction debris and materials from bottom of manholes, catch basins and sewers when the Work is complete.

3.14 Removal and Replacement of Existing Manholes, Catch Basins and Catch Pits

.1 Remove and replace existing manholes, catch basins and catch pits where indicated on the Drawings and Specifications as excavation progresses. Install replacement manholes, catch basins and catch pits in accordance with SD-010, SD-010D, SD-011, SD-023, SD-024 and SD-025, Section 3.8 of this specification and the following requirements

.1 Cut fully through existing sewer pipe or catch basin lead pipe leaving neat, square ends before removing the existing catch basin, catch pit or manhole base. Alternately, remove existing sewer pipe or catch basin lead pipe at a joint location within the excavation.

.2 Install new sewer pipe or catch basin lead pipe of specified size and type from new manhole, catch basin or catch pit to existing sewer pipe or catch basin lead pipe.

.3 Connect to existing sewer pipe or catch basin lead pipe with approved coupling, adapter or bushing to make a watertight connection.

.2 Remove construction debris and materials from manholes, catch basins, catch pits and sewers when the Work is complete.

3.15 Connecting New Sewers and Catch Basin Leads to Existing Manholes, Catch Basins and Catch Pits

.1 Connect new sewers and catch basin leads to existing manholes, catch basins and catch pits at locations and elevations shown on the Drawings.

.2 Excavate required depth and make neat hole in manhole, catch basin or catch pit wall a maximum of 25 millimetres larger than outside diameter of the sewer or catch basin lead pipe.

.3 Connect sewers, catch basin leads and drainage connection pipes in accordance with Section 3.8 of this specification.

.4 Connect catch basin leads to existing manholes at a depth of 2.4 to 4.0 metres below finished grade and from 600 millimetres to 900 millimetres above the manhole floor where the manhole floor is between 3.0 and 4.0 metres below finished grade

.5 Install approved catch basin hood in accordance with AP-012, SD-024 and SD-025. Reuse existing catch basin hood if not damaged and approved by Contract Administrator.

.6 Cut existing catch basin lead pipe flush with catch basin or catch pit wall and plug opening with mortar or concrete to make watertight.

.7 Re- bench and re-channel manhole floor as required with mortar or concrete in accordance with SD-010 and SD-011. Curve flow channels for perpendicular connections smoothly into main flow channel.

.8 Remove construction debris and materials from existing manholes, catch basins, catch pits and sewers.

3.16 Connecting New Sewer or Sewer Service to Existing Sewer

.1 Connect to existing sewer fittings where provided with approved coupling, adapter or bushing to make a watertight connection.

.2 Connect to existing vitrified clay pipe sewers where no fitting is provided by removing the required length of sewer pipe and installing an approved tee, required lengths of new sewer pipe and flexible couplings, bushing or adapters in accordance with Section 3.12 of this specification.

.1 Where approved by the Contract Administrator a connection can be made to 300 millimetre and larger vitrified clay sewers with an approved PVC saddle in accordance with clause 3.16.3.2 of this specification.

.3 Connect to other types of existing sewers where no fitting is provided using one of the following methods.

.1 Remove a section of existing sewer pipe and install an approved tee. or

.2 Make a neat circular hole in the existing sewer the same size as the sewer or sewer service to be connected and install an approved PVC saddle in accordance with the manufacturer's instructions using stainless steel straps or 6 millimetre diameter stainless steel bolts.

.1 Maximum connection to an existing sewer using a PVC saddle to be two sizes smaller than the sewer pipe.

.2 Install fastening bolts with head on the inside of the sewer pipe. Use washers if hole has chipped during drilling. Do not over tighten bolts to cause stress or damage to existing sewer pipe.

.3 Limit excavation beneath existing sewer to only what is required to install saddle straps. Fill excavation beneath existing sewer with grout or cement stabilized fill.

.3 Make a neat circular hole in the existing sewer a maximum of 25 millimetres larger than sewer or sewer service pipe to be connected. Insert a short piece of sewer or service pipe into the hole with the bell end resting on the outside of the existing sewer pipe. Grout around and between the sewer or service pipe bell and the existing sewer pipe wall with mortar in accordance with SD-009 or construct a concrete collar in accordance with the Drawings to make a watertight connection.

.4 Make holes in existing sewer pipes using the following methods.

.1 Non-reinforced monolithic concrete sewer and pre-cast reinforced concrete pipe 900 millimetres in diameter and larger: by concrete coring.

.2 Pipes less than 900 millimetres in diameter: by concrete coring or drilling a series of 12 millimetre diameter holes with a masonry drill bit around the circumference of the hole and carefully tapping out the coupon.

.1 Drill holes at 15 millimetres on centre for sewer pipes 375 millimetre diameter and smaller and at 25 millimetres on centre for sewer pipes up to and including 900 millimetre diameter.

.3 PVC pipe: by coring or cutting with hole saw or other tool capable of cutting a circular opening.

.5 Ensure the new sewer or service pipe does not protrude more than 19 millimetres into the existing sewer.

.6 Remove all construction debris and materials from the existing sewer when the Work is complete.

.7 Perform a video inspection of the existing sewer after completion of backfilling and compaction using the video equipment indicated in CW 2145 from the nearest manhole to a minimum of 2 metres past the new connection. Provide the DVD of the inspection to the Contract Administrator for review. The video inspection is to clearly show the distance from the manhole to the connection and the connection. Coding of the video inspection will not be required.

.8 Submit video inspections of existing sewers equal to or smaller than 450 millimetres in size for a new service connection done under a Service Permit within 90 Calendar days of the completion of the new service connection. Video inspection of existing sewers larger than 450 millimetres in size are not required for a new sewer service connection made under a Service Permit.

3.17 Connecting to Existing Sewer and Sewer Service Stubs

.1 Remove the existing plug and connect the new sewer or sewer service pipe to the existing sewer pipe with an approved coupling, adapter or bushing to make a watertight connection.

3.18 Connecting Existing Sewer Service to New Sewer

.1 Locate existing sewer service by dye tracing, electronic tracing, video inspection or other methods approved by the Contract Administrator.

.2 Excavate and connect to the existing sewer service pipe at the location shown on the Drawings or within the limits of excavation for on-line sewer renewals unless otherwise directed by the Contract Administrator.

.3 Cut fully through the existing sewer service pipe leaving a neat square end or remove existing

sewer service pipe at a joint location within the excavation.

.4 Connect the new sewer service pipe to the existing sewer service pipe or joint using an approved flexible transition coupling, adaptor or bushing to make a watertight connection.

.5 Install fittings, riser pipe, required length of new sewer service pipe and connect to the tee on the new sewer in accordance with Section 3.10 of this specification.

3.19 Plugging and Abandoning Existing Sewers and Sewer Services

.1 Abandon existing sewers and sewer services smaller than 300 millimetres in diameter by completely plugging each end at a manhole or where cut off with mortar or concrete a minimum of 300 millimetres thick.

.2 Abandon existing sewers and sewer services 300 millimetres in diameter and larger by plugging one end with mortar or concrete and completely filling the sewer or sewer service with cement-stabilized flowable fill. Confirm all active sewer services have been disconnected from sewer being abandoned and have been reconnected to new sewer before filling the sewer.

.3 Abandon sewer services under pavement by installing a plug within 1.0 metre of the sewer and filling with flowable cement-stabilized fill in accordance with SD-021 except where the existing sewer itself will be abandoned with flowable cement-stabilized fill.

.4 Perform a video inspection of the existing sewer using the equipment indicated in CW 2145 from the nearest manhole to a minimum of 2 metres past the abandoned sewer service and provide the DVD to the Contract Administrator for review. The video inspection is to clearly show the distance from the manhole to the abandoned sewer service. Cleaning of the sewer and coding of the video inspection will not be required.

.5 Video inspection of existing sewers is not required after plugging and abandoning existing sewer services under a Service Permit.

3.20 Abandoning, Relocation and Removal of Existing Manholes, Catch Basins, Catch Pits and Drainage Inlets

.1 Abandon existing manholes, catch basins and catch pits by removing the frame and cover, flat top reducers and riser sections to a minimum of 1.2 metres below existing or proposed finished grade.

.2 Abandon existing drainage inlets and inlet box by removing the inlet frame and inlet box cover and completely demolishing the concrete inlet box.

.3 Relocate existing manholes, catch basins and catch pits by completely removing the structure from the existing location and installing at the location shown on the Drawings.

.4 Remove existing manholes, catch basins and catch pits by completely removing the entire structure from the ground.

.5 Plug sewers and sewer services and drainage inlet pipe connected to abandoned or removed manholes, catch basins, catch pits and drainage inlet boxes in accordance with Section 3.19 of this specification. Backfill the remainder of the manhole, catch basin or excavation with compacted Class of Backfill indicated on the Drawings and Specifications in accordance CW 2030.

.6 Load and deliver salvaged frames and covers as directed by the Contract Administrator to the

Water and Waste Department, Water Services Division Yard located at 552 Plinguet Street. Unload salvaged material as directed by City personnel.

3.21 Maintaining Flow in Existing Sewers

.1 Maintain flow in existing sewers and sewer services during renewal, repair and any other time construction activities may impede or interrupt flow by methods such as diversion through the excavation, redirecting flow or providing by-pass pumping.

.2 Provide details of methods for maintaining flow in existing sewers to the Contract Administrator for review prior to beginning the Work.

.3 Flow control by temporary sewer isolation and by-pass pumping to be in accordance with Section 3.13 of CW 2140.

.4 Provide approved traffic ramps for by-pass pumping discharge hoses where crossing roadways and traffic lanes and locate where directed and approved by the Contract Administrator.

3.22 Deflection Testing of SDR 35 PVC Sewers

.1 Perform deflection testing of SDR 35 PVC pipe in the presence of the Contract Administrator by pulling a cylindrical shaped mandrel constructed with 9 evenly spaced arms generally conforming to SD-020 through the sewer after installation of sewer services and no sooner than 24 hours after compaction of backfill.

.2 Position the mandrel a minimum of 4 metres in front of the camera if deflection testing is performed with video inspection.

.3 Allowable deflection to be no greater than 0.15 times the pipe SDR as indicated in Table CW 2130.1. Deflection is expressed as a percent of the base inside diameter of the sewer pipe as defined in the ASTM standard to which the pipe is manufactured.

.4 Mandrel diameter will be checked with a go/no-go proving ring having an inside diameter equal to 2 times the specified Mandrel arm radius. Mandrels passing through the proving ring will not be allowed for deflection testing.

.5 Sewer pipe that does not allow the mandrel to pass will be considered to have failed deflection testing and is to be replaced or re-bedded as directed by the Contract Administrator.

Table CW 2130.1 Mandrel and Proving Ring Dimensions for SDR 35 PVC Pipe

Nominal Pipe Size (millimetres)	Mandrel Arm Radius (millimetres)	Mandrel Contact Length (millimetres)	Proving Ring Inside Diameter (millimetres)
250	115.70	200	231.40
300	137.46	250	274.92
375	168.17	300	336.34
450	205.41	350	410.82
525	242.03	450	484.12
600	272.03	500	544.06

3.23 Reinforced Concrete Pipe Three Edge Bearing Test

.1 The Contract Administrator will randomly select one pipe of each size and class from the pipe supplied for the sewer installation for a three-edge bearing testing in accordance with ASTM C 497. Deliver selected pipe to supplier and perform testing to ultimate failure in presence of

Contract Administrator.

3.24 Sewer Cleaning

.1 Clean sewers in accordance with CW 2140 if required before performing video inspection except for Clause 3.5.7.1, Sections 3.6, 3.7, 3.8 and Clause 3.9.6 and their associated payment clauses which do not apply to new sewer installations.

3.25 Video Inspection

.1 Perform video inspection of sewers in accordance with CW 2145 except for Sections 3.18, 3.19, 3.21 and 3.22 and their associated payment clauses which do not apply to sewer repairs and new sewer installations.

.2 Perform video inspection of catch basin leads longer than 15 metres in length or that extend from a sewer or manhole to a catch basin at a rear lot line, in a public lane, in a park area or in a parking lot.

3.26 Restoration

.1 Replace concrete pavement slabs, miscellaneous concrete slabs, curbs and asphalt pavement or overlays in accordance with CW3230, CW 3235, CW 3240 and CW 3410 as indicated in the Specifications and as directed by the Contract Administrator. Use “early opening” concrete in accordance with the CW 3310 as indicated in the Specifications and as directed by the Contract Administrator.

.2 Restore boulevards and grassed areas by sodding or seeding using imported topsoil in accordance with CW 3510 and CW 3520 as indicated in the Specifications and as directed by the Contract Administrator.

.3 Restore gravel surfaces in accordance with CW 3150 as indicated in the Specifications and as directed by the Contract Administrator.

4. MEASUREMENT AND PAYMENT

4.1 Sewer Installation

.1 Sewer installation will be measured for payment on a length basis for each size, type of pipe material, method of installation, type of bedding, type of backfill and depth and paid for at the Contract Unit Price per metre for the Items of Work listed below. Length to be paid for will be total number of linear metres supplied and installed in accordance with this specification, accepted and measured by the Contract Administrator.

Items of Work:

Combined Sewers
Interceptor Sewers
Land Drainage Sewers
Storm Relief Sewers
Wastewater Sewers

.2 Measurement for length of sewer installed in a trench will be made horizontally at grade above the centreline of pipe through fittings from centre to centre of manholes.

.3 Measurement for length of sewer installed using trenchless methods will be made horizontally at grade above the centreline of pipe through shafts from centre to centre of manholes.

.4 Measurement for length of sewer installed using trenchless methods between sewers installed in a trench will be made horizontally at grade above the centreline of pipe from face to face of the trench excavation.

.5 Sewers specified to be installed using trenchless methods but were installed in a trench due to field conditions will be paid for at the Contract Unit Price per metre for trenchless installation.

.6 Depth classification for sewers installed in a trench will be from 0 to 4 metres then in 1.0 metre increments. No further subdivision will be made for depth. Depth will be the average depth between adjacent manholes measured from existing or proposed final grade to the lowest sewer invert. No depth classification will be made for sewers installed by trenchless methods.

.7 Connecting new sewers to new manholes will be included in sewer installation.

.8 Repair of damage to underground and surface structures due to surface subsidence and soil heaving caused by trenchless installation methods will be at own expense.

.9 Correction of alignment and grade exceeding the allowable variance will be at own expense.

.10 Replacement or re-bedding of sewers that do not allow the mandrel to pass will be at own expense.

4.2 Fitting Installation

.1 Supply and installation of sewer fittings and couplings will be included in sewer installation.

4.3 Manholes

.1 Manhole installation including frames, covers, rungs, risers, base and other accessories and appurtenances will be measured for payment on a vertical length basis for each manhole type and base size and paid for at the Contract Unit Price per vertical metre for the Items of Work listed below. Length to be paid for will be the total number of vertical metres of manhole supplied and installed in accordance with this specification, accepted and measured by the Contract Administrator.

Items of Work:
Manhole
Manhole With Internal Drop Pipe
New Manhole on Existing Sewer
Remove and Replace Existing Manhole

.2 Measurement of manholes will be from the lowest sewer invert to the top of the finished rim elevation.

.3 Pipe, couplings and connections to existing sewer required to install a new manhole on an existing sewer will be included in manhole installation.

.4 Removal of existing manhole will be included with installation of new manhole.

.5 Internal pipe, fittings, couplings, anchors, spacers and fasteners will be included with installation of new manhole with internal drop pipe.

4.4 Catch Basins and Catch Pits

.1 Catch basin and catch pit installation including hoods, fittings, frame and cover and other accessories and appurtenances will be measured for payment on a unit basis for each type and paid for at the Contract Unit Price for the Items of Work listed below. Number of units to be paid for will be the total number of catch basins and catch pits supplied, installed and removed where required in accordance with this specification, accepted and measured by the Contract Administrator.

Items of Work:

Catch Basin
Catch Pit
Remove and Replace Existing Catch Basin
Remove and Replace Existing Catch Pit

.2 Reconnection of up to 1.0 metre of catch basin lead measured from the outside of the catch basin, including lead pipe and couplings will be included in catch basin and catch pit installation.

4.5 Sewer Service Installation

.1 Sewer service installation will be measured for payment on a length basis for each size, type of backfill and method of installation and paid for at the Contract Unit Price per metre for “Sewer Services”. Length to be paid for will be the total number of linear metres of sewer service supplied and installed in accordance with this specification, accepted and measured by the Contract Administrator.

.2 Measurement for length of sewer service installed in a trench will be made horizontally at grade, above the centreline of the sewer service through fittings from sewer centreline to termination point of sewer service.

.3 Measurement for length of sewer service installed using trenchless methods will be made horizontally at grade above the centreline of the sewer service through shafts from sewer centreline to termination point of the sewer service.

.4 Fittings for sewer services will be included in sewer service installation.

.5 Connection to saddle, tee or wye provided on sewer will be included in sewer service installation.

4.6 Drainage Connection Pipe Installation

.1 Drainage connection pipe installation will be measured for payment on a length basis and paid for at the Contract Unit Price per metre for “Drainage Connection Pipe”. Length to be paid for will be the total number of linear metres of drainage connection pipe supplied and installed in accordance with this specification, accepted and measured by the Contract Administrator.

.2 Measurement for length of drainage connection pipe installed in a trench will be made horizontally at grade, above the centreline of the drainage connection pipe through fittings from the centreline of the inlet box or catch pit to the centreline of the catch basin.

.3 Fittings for drainage connection pipe will be included in drainage connection pipe installation.

4.7 Sewer Service Risers

.1 Sewer service riser installation will be measured for payment on a vertical length basis for each

type and size and paid for at the Contract Unit Price per metre for "Sewer Service Risers". Length to be paid for will be the total number of vertical metres of sewer service risers supplied and installed in accordance with this specification, accepted and measured by the Contract Administrator.

.2 Measurement for vertical length of sewer service risers will be from the top of the sewer to the top of the sewer service pipe in accordance with SD-014 and SD-015.

.3 Fittings for sewer service risers will be included in sewer service riser installation.

4.8 Sewer Repairs

.1 Sewer repairs made by replacing up to 3.0 continuous metres in length will be measured for payment on a unit basis for each size and type of backfill and paid for at the Contract Unit Price for “Sewer Repair – Up to 3.0 Metres Long”. Number of units to be paid for will be the total number of sewer repairs up to 3.0 metres long supplied and installed in accordance with this specification, accepted and measured by the Contract Administrator.

.2 Sewer repairs made by replacing additional pipe continuous to the first 3.0 metres of pipe will be measured for payment on a length basis for each size and type of backfill and paid for at the Contract Unit Price for “Sewer Repair – In Addition to First 3.0 metres”. Length to be paid for will be the total number of linear metres of sewer repair additional to the first 3.0 metre repair supplied and installed in accordance with this specification, accepted and measured by the Contract Administrator.

.3 Measurement will be made horizontally at grade above the centreline of pipe through fittings from connection to connection to existing sewer.

.4 Supply and installation of couplings and connections to existing sewer pipe will be included in sewer repairs.

.5 Repairs completed beyond limits confirmed with Contract Administrator will not be measured for payment.

.6 Video inspection required to confirm limits of sewer repair will be included in sewer repairs.

4.9 Existing Manhole and Catch Basin Repairs

.1 Replacing existing manhole and catch basin frames and covers will be measured for payment on a unit basis for each type and paid for at the Contract Unit Price for the Items of Work listed below. Number of units to be paid for will be the total number of manhole and catch basin frames and covers supplied and installed in accordance with this specification, accepted and measured by the Contract Administrator.

Replacing Standard Frames and Covers

i) AP-004 - Standard Frame for Manhole and Catch Basin
ii) AP-005 - Standard Solid Cover for Standard Frame
iii) AP-006 - Standard Grated Cover for Standard Frame
iv) AP-008 – Barrier Curb and Gutter Inlet Frame and Box
v) AP-009 – Barrier Curb and Gutter Inlet Cover
vi) AP-011 – Mountable Curb and Gutter Inlet

.2 Installing new or replacing existing flat top reducers will be measured for payment on a unit basis for each size and paid for at the Contract Unit Price for “Installing New Flat Top Reducer” or “Replacing Existing Flat Top Reducer”. Amount to be paid for will be the total number of flat top

reducers supplied and installed in accordance with this specification, accepted and measured by the Contract Administrator.

.3 Replacing existing manhole risers will be measured for payment on a vertical metre basis for each size and paid for at the Contract Unit Price for the Items of Work listed below. Length to be paid for will be the total number of vertical metres of risers supplied and installed in accordance with this specification, accepted and measured by the Contract Administrator.

Replacing Existing Risers

i) Pre-cast concrete risers
ii) Brick risers
iii) Cast-in-place concrete

.4 Patching the interior of existing manholes will be measured for payment on a vertical metre basis and paid for at the Contract Unit Price for "Patching Existing Manholes". Length to be paid for will be the total number of vertical metres patched in accordance with this specification, accepted and measured by the Contract Administrator.

.5 Re-pointing and replacing existing manhole brickwork will be measured for payment on a vertical metre basis and paid for at the Contract Unit Price for "Re-pointing Brickwork". Length to be paid for will be the total number of vertical metres of brickwork re-pointed in accordance with this specification, accepted and measured by the Contract Administrator.

.6 Replacing existing manhole rungs will be measured for payment on a unit basis and paid for at Contract Unit Price for "Replacing Existing Manhole or Catch Basin Rungs". Number of units to be paid for will be total number of manhole rungs supplied and installed in accordance with this specification, accepted and measured by the Contract Administrator.

.7 Replacing existing catch basin hood, pin or wall hook will be measured for payment on a unit basis and paid for at Contract Unit Price for "Replacing Existing Catch Basin Hoods, Pins or Wall Hooks". Number of units to be paid for will be total number of catch basin hoods, pins or wall hooks supplied and installed in accordance with this specification, accepted and measured by the Contract Administrator.

4.10 Connecting New Sewers and Sewer Services to Existing Manholes, Catch Basins and Catch Pits

.1 Connecting new sewers and sewer services to existing manholes, catch basins and catch pits will be measured for payment on a unit basis for each size and type of connection and paid for at the Contract Unit Price for the Items of Work listed below. Number of units to be paid for will be the total number of connections supplied and installed in accordance with this specification, accepted and measured by the Contract Administrator.

Items of Work

Connecting to Existing Manhole
Connecting to Existing Catch Basin
Connecting to Existing Catch Pit
Connecting to Existing Inlet Box

4.11 Connecting New Sewer or Sewer Service to Existing Sewer

.1 Connecting new sewers and sewer services to existing sewers where no stub or fitting exists will be measured for payment on a unit basis for each size and type of new sewer or sewer service and each size and type of existing sewer and paid for at the Contract Unit Price for "Connecting to Existing Sewer". Number of units to be paid for will be total number of connections supplied and installed in accordance with this specification, accepted and measured by the Contract Administrator.

.2 Supply and installation of sewer pipe, couplings, tees and saddles will be included with the sewer connection.

4.12 Connecting to Existing Sewer or Sewer Service Stubs

.1 Connecting to existing sewer or sewer service stubs will be included with the sewer or sewer service installation.

4.13 Connecting Existing Sewer Service to New Sewer

.1 Connecting existing sewer services to new sewers will be measured for payment on a unit basis for each size and paid for at the Contract Unit Price for "Connecting Existing Sewer Service to New Sewer". Number of units to be paid for will be the total number of connections supplied and installed in accordance with this specification, accepted and measured by the Contract Administrator.

.2 Supply and installation of fittings will be included in the sewer service connection.

.3 Supply and installation of sewer service risers will be measured and paid for in accordance with Section 4.7.

.4 Supply and installation of sewer service pipe will be measured and paid for in accordance with Section 4.5.

.5 Supply and installation of up to 1.0 metre of new sewer service pipe measured horizontally at grade above the centreline of the sewer service pipe from the outside of the new sewer main will be included with the connection of existing sewer services to a new sewer renewed on-line.

4.14 Plugging and Abandoning Existing Sewers and Sewer Services

.1 Cutting off and plugging existing sewers and sewer services smaller than 300 millimetres in diameter will be measured for payment on a unit basis for each size and paid for at the Contract Unit Price for "Plugging Existing Sewers and Sewer Services Smaller Than 300 Millimetres". Number of units to be paid for will be the total number of sewers and sewer services plugged in accordance with this specification, accepted and measured by the Contract Administrator.

.2 Abandoning existing sewers larger than 300 millimetres in diameter with cement-stabilized flowable fill will be measured for payment on a volume basis and paid for at the Contract Unit Price for "Abandoning Existing Sewers With Cement-Stabilized Flowable Fill". Volume to be paid for will be the total number of cubic metres of sewer abandoned in accordance with this specification, accepted and measured by the Contract Administrator.

.3 Volume of cement-stabilized flowable fill used will be calculated based on the inside diameter and length of the sewer abandoned.

.4 Abandoning existing sewer services under pavement with flowable fill will be measured for payment on a unit basis for each size and paid for at Contract Unit Price for "Abandoning Existing Sewer Services Under Pavement". Number of units to be paid for will be the total number of sewer services abandoned in accordance with this specification, accepted and measured by the Contract Administrator.

4.15 Abandoning, Relocation and Removal of Existing Manholes, Catch Basins, Catch Pits and Drainage Inlets

.1 Abandoning of existing manholes, catch basins and catch pits will be measured for payment on a unit basis and paid for at the Contract Unit Price for "Abandoning Existing Manholes, Catch Basins and Catch Pits". Number of units to be paid for will be the total number of manholes, catch basins and catch pits abandoned in accordance with this specification, accepted and measured by the Contract Administrator.

.2 Abandoning of existing drainage inlets and inlet boxes will be measured for payment on a unit basis and paid for at the Contract Unit Price for "Abandoning Existing Drainage Inlets", Number of units to be paid for will be the total number of drainage inlets abandoned in accordance with this specification, accepted and measured by the Contract Administrator.

.3 Removal of existing manholes, catch basins and catch pits that will not be replaced at the same location will be measured for payment on a unit basis and paid for at the Contract Unit Price for "Removal of Existing Manholes, Catch Basins or Catch Pits". Number of units to be paid for will be the total number of manholes, catch basins and catch pits removed in accordance with this specification, accepted and measured by the Contract Administrator.

.4 Removal of existing manholes, catch basins, catch pits and curb inlets that will be replaced by a new manhole, catch basin or catch pit at the same location will be included with manhole, catch basin or catch pit installation.

.5 Relocation of existing manholes, catch basins and catch pits will be measured for payment on a unit basis for each size and type and paid for at Contract Unit Price for "Relocation of Existing Manholes, Catch Basins and Catch Pits". Number of units to be paid for will be the total number of manholes, catch basins and catch pits relocated in accordance with this specification, accepted and measured by the Contract Administrator.

4.16 Maintaining Existing Sewer Flow

.1 Maintaining existing sewer flow and will be included with type of sewer work being done.

4.17 Sewer Cleaning

.1 Cleaning of new sewers will be included with sewer installation.

4.18 Video Inspection

.1 Video inspection will be measured and paid for in accordance with CW 2145 except Section 4.6 and 4.7 will not apply to new sewer installations.

4.19 Deflection Testing of SDR 35 PVC Sewers

.1 Deflection testing of SDR 35 PVC sewers will be included with sewer installation.

4.20 Concrete Pipe Three Edge Bearing Test

.1 Concrete pipe three edge bearing test will be measured for payment on a unit basis for each size and type of pipe and paid for at the Contract Unit Price for "Concrete Pipe Three-Edge Bearing Test". Number of units to be paid for will be the total number of pipes tested in accordance with this specification, accepted and measured by the Contract Administrator.

4.21 Pavement Restoration

.1 Renewal of existing concrete pavement slabs will be measured on a surface area basis per square metre in accordance with CW 3230. No separate measurement or payment will be made for Drilled Dowels or Tie Bars, the cost for which shall be included in the prices bid for the renewal of the concrete pavement.

.2 Removal and replacement of existing miscellaneous concrete slabs, curbs and asphalt pavement or overlays will be measured for payment in accordance with CW 3235, CW 3240 and CW 3410.

4.22 Boulevard Restoration

.1 Restoration of boulevards and grassed areas disturbed by construction activities will be included with the sewer work being done.

.2 Restoration of boulevard and grassed areas beyond the limits of construction as directed by the Contract Administrator will be measured for payment in accordance with CW 3510 and CW 3520.

CW 2160 - CONCRETE UNDERGROUND STRUCTURES AND WORKS

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CW 2160 - CONCRETE UNDERGROUND STRUCTURES AND WORKS

1. DESCRIPTION

1.1 General

.1 This specification covers the construction of concrete underground structures and works including formwork, reinforcement, sleeves and inserts, water stops, curing, finishing, waterproofing and other related operations.

1.2 Referenced Standard Construction Specifications

.1 CW 1110 General Instructions
.2 CW 2030 Excavation, Bedding and Backfill

1.3 Referenced Industry Standards

.1 ASTM D6103 Standard Test Method for Flow Consistency of CLSM
.2 CSA A23.1 Concrete Materials and Methods of Construction
.3 CSA A23.2 Methods of Test for Concrete
.4 CSA S269.3 Concrete Formwork

2. MATERIALS

2.1 Portland Cement

.1 Portland cement: in accordance with CSA A5 A3001 Type GU/GUL and Type HS/HSL.

.2 The Contract Administrator may make random check tests of previously approved cement for compliance with Clause 2.1.1. Replace cement that fails to meet the specified requirements.

2.2 Aggregate

.1 Aggregate: in accordance with CSA A23.1.

.2 Grading to be in accordance with the requirements of CSA A23.1.

.3 Quarried limestone and dolomite will not be acceptable as aggregate.

.4 Provide the Contract Administrator with the location of sources where aggregate will be obtained to allow for inspection and tentative approval. Obtain approval from the Contract Administrator to change the source of aggregate supply during the course of the Work.

2.3 Supplementary Cementing Materials

.1 Supplementary cementing materials: in accordance with CSA A3001 Class CI Fly Ash.
.2 Fly ash must be tested with the cement and comply with the sulphate expansion requirements for Type HSb/HSLb blended hydraulic cement in CSA A3001. Limit fly ash content to 25% of cementitious materials except for cement stabilized fill which can have up to 70 kilograms of fly ash in the mix.

.3 Provide material and testing information for fly ash to the Contract Administrator and obtain written approval before using.

2.4 Water

.1 Water: in accordance with CSA A23.1 and equal to potable water in physical and chemical properties.

2.5 Admixtures

.1 Admixtures to be as follows.

.1 Air-entraining agent: in accordance with ASTM C260.

.2 Water-reducing agent: in accordance with ASTM C494.

.3 Other admixtures: in accordance with the Specifications.

.4 Obtain approval from the Contract Administrator before using additional admixtures.

.5 Admixtures that contain chloride will not be permitted.

2.6 Reinforcing Steel

.1 Reinforcing steel: in accordance with CSA G30.18 Grade 400W.

.1 Stirrups, ties and bar mats up to 10 millimetres in diameter: Grade 400R and 400W plain bars.

.2 Chairs, bolsters, bar supports, spacers and accessories: in accordance with CSA A23.1.

.2 Remove reinforcing steel the Contract Administrator has determined exhibits flaws in manufacture or fabrication. Rust, surface seams, or surface irregularities will not be cause for rejection provided minimum dimensions, cross-sectional area and tensile properties of a hand wire-brushed specimen are not less than requirements of CSA G30.18.

2.7 Water Stops

.1 Water stops: extruded Polyvinyl Chloride (PVC) in accordance with CGSB 41-GP-35M and the following unless otherwise indicated in the Specifications.

.1 Minimum 125 millimetres wide by 9.5 millimetres thick.

.2 Multi-ribbed with center bulb.

.3 Minimum 12 MPa tensile strength.

.4 275% allowable elongation.

.5 -45 degree C to 80 degree C working temperature range.

2.8 Curing Compound

.1 Curing compound: liquid membrane forming compound in accordance with ASTM C309 as approved by Contract Administrator unless otherwise indicated in the Drawings and Specifications.

2.9 Grout and Mortar

.1 Grout and mortar: one part Type GU/GUL cement and one part sand with sufficient water to produce a stiff mortar-like consistency capable of developing a 20 MPa compressive strength after 28 days.

2.10 Bonding Agent

.1 Bonding agent: in accordance with the Specifications.

2.11 Formwork

.1 For concrete without special architectural features use Douglas Fir plywood made with waterproof glue specifically manufactured for concrete formwork in accordance with CSA O121.

.2 For concrete with special architectural features use formwork materials in accordance CSA A23.1.

.3 For surfaces and rough work that will not be exposed to view use square edge dimension lumber.

.4 Use other types of formwork in accordance with the Specifications

2.12 Form Ties

.1 For concrete without special architectural features use removable or snap-off metal ties of fixed or adjustable length free of devices that will leave holes larger than 25 millimetres in diameter in concrete surfaces.

.2 For Architectural concrete use snap-off ties complete with plastic cones and light grey concrete plugs.

.3 Use other types of snap-off ties in accordance with the Drawings and Specifications.

2.13 Form Coating

.1 Form coating to be colourless, non-staining mineral oil free of kerosene compatible with concrete surfaces that will have a permanent finish coating unless otherwise indicated in the Drawings and Specifications.

2.14 Waterproofing

.1 Waterproofing: to be emulsified asphalt in accordance with CAN/CGSB 37.1 or CANCGSB 37.2 unless otherwise indicated in the Specifications.

2.15 Storage of Materials

.1 Store materials in accordance with the requirements of CSA A23.1.

.2 Provide a method of storage to readily permit inspection, sampling and identification of material by the Contract Administrator.

2.16 Concrete Mix Design

.1 Proportion fine aggregate, coarse aggregate, cement, water, air-entraining agent, and water-reducing agent to yield concrete having required strength, water/cement ratio, slump, air content, cement content and workability in accordance with Table CW 2160.1.

TABLE CW 2160.1 DESIGN REQUIREMENTS FOR CONCRETE USED FOR UNDERGROUND STRUCTURES

Type of Structure or Use	**A) Monolithic sewers and reinforced structures.**	**B) Pipe foundations, skin coats, base blocks, thrust blocks, buttresses and anchors**	**C) Cement - Stabilized Fill**	**D) Flowable Cement - Stabilized Fill**
Maximum Size of Aggregate (mm)	20	20	20	5
Cement Type	Type HS/HSL		Type GU/GUL	
Maximum Water/Cementing Materials Ratio	0.45	0.45	Not Applicable	
Compressive Strength at 28 days	32 MPa	32 MPa	1.5 to 2.5 MPa	
Slump/Flow	80 +/- 20 mm	100 +/- 30 mm	Not Applicable	200 mm Minimum
Air Content	4 to 7%		Not Applicable	20% Minimum
Minimum Cementing Materials Content	As Required to Meet Specified Compressive Strength			

.2 Provide a “Mix Design Statement” for each type of concrete to be used certifying constituent materials and mix proportions to the Contract Administrator at least 2 weeks before delivery of concrete to the Site. Supply reasonable evidence to the Contract Administrator that mix proportions selected will produce concrete meeting the specified strength, workability and yield.

.3 If used, water-reducing agent not to exceed the manufacturer's recommended quantity.

.4 Do not make changes to approved mix designs without approval of the Contract Administrator.

2.17 Concrete Inspection and Testing

.1 Inspection and testing of concrete and concrete materials will be in accordance with CSA A23.1 and carried out by a Testing Laboratory designated by the Contract Administrator. Quality control tests for concrete will be used to determine the acceptability of the concrete supplied.

.2 Provide without charge samples of concrete and constituent materials required for quality control tests and provide assistance and use of tools and construction equipment as is required.

.3 The frequency and number of concrete quality control tests will be in accordance with the requirements of CSA A23.1.

.4 Non-destructive methods for testing concrete will be in accordance with CSA A23.2.

.5 An outline of the quality control testing is as follows.

.1 Samples of concrete for test specimens will be taken in accordance with CSA A23.2-1C.

.2 Slump tests will be performed in accordance with A23.2-5C. If measured slump falls outside limits specified in Table CW 2160.1 a second test will be made. In the event of a second failure the Contract Administrator reserves right to refuse the batch of concrete represented.

.6 Air content test will be performed in accordance with CSA A23.2-4C. If measured air content falls outside limits specified in Table CW 2160.1 a second test will be made at any time within the specified discharge time limit for the mix. In the event of a second failure the Contract Administrator reserves the right to reject the batch of concrete represented.

.7 Compressive strength test specimens will taken in accordance with CSA A23.2-3C.

.8 Compressive strength tests at 28 days will be the basis for acceptance of all concrete supplied. For each 28 day test the strength of two companion standard-cured test specimens will be determined in accordance with CSA A23.2-9C. Test result will be the average strength of both specimens.

2.18 Shop Drawings

.1 Submit Shop Drawings for reinforcement in accordance with Specification CW1110.

.2 Prepare reinforcement drawings in accordance with “Reinforcing Steel Manual of Standard Practice” by the Reinforcing Steel Institute of Canada and include the following information.

.1 Bar bending details, lists, quantities of reinforcement, sizes, spacing, locations of reinforcement.

.2 Location and details of mechanical splices approved by the Contract Administrator.

.3 Identifying code marks to permit correct placement of reinforcement without reference to structural drawings.

.4 Sizes, spacing and locations of chairs, spacers and hangers.

.5 Detail lap lengths and bar development lengths in accordance with CAN3-A23.3.

3. CONSTRUCTION METHODS

3.1 Excavation

.1 Excavate for underground structures in accordance with CW 2030.

3.2 Concrete Formwork

.1 Fabricate and erect concrete formwork in accordance with CSA S269.3 and CSA A23.1. Finished concrete to conform to shape, dimensions, locations and elevations as shown on the Drawings and within the tolerances required by CSA A23.1.

.2 Ensure sheets and pieces of lumber are of uniform thickness sized to prevent sagging between supports and withstand the action of vibrators. Align form joints to be flush and tight to prevent water and mortar leakage.

.3 Provide a minimum 25 millimetre fillet at interior corners and a 25 millimetre chamfer at exterior corners.

.4 Brace, support and tie forms together to prevent displacement and movement during steel reinforcement and concrete placement.

.5 Thoroughly clean formwork, remove loose particles or dried concrete and coat with non-staining mineral oil in accordance with CSA A23.1 before erecting. Do not use chemicals to remove ice or foreign materials from forms.

.6 Earth structures will be permitted as formwork for concrete monolithic sewers, Type B) structures as indicated in Table CW 2160.1 and other structures indicated in the Specifications or directed by the Contract Administrator.

3.3 Formed Openings

.1 Form openings in walls and floors at the locations and to the dimensions shown on the Drawings. Provide water stop and keyway in the face of openings where fill-in concrete will be placed after pipe, frame, fitting or sleeve is installed.

3.4 Fabrication and Placing of Steel Reinforcement

.1 Fabricate steel reinforcement in accordance with CSA A23.1, ANSI/ACI 315, “The Reinforcing Steel Manual of Standard Practice” by the Reinforcing Steel Institute of Canada and in accordance with the Specifications.

.2 Obtain the Contract Administrator’s approval for steel reinforcement splices at locations other than those shown on the Shop Drawings. Splice laps to be in accordance with CSA A23.3.

.3 Clearly identify steel reinforcement in accordance with the bar bending details and lists shown on the Shop Drawings.

.4 Do not field bend or field weld steel reinforcement except where shown on the Shop Drawings or authorized by the Contract Administrator. Bend steel reinforcement without using heat when field bending is authorized. Replace bars that develop cracks or splits.

.5 Locate and place steel reinforcement as shown on the Shop Drawings and in accordance with CSA A23.1.

.6 Adequately support and secure steel reinforcement against displacement and maintain the required cover from forms during concrete placing using methods and products in accordance with CSA A23.1.

3.5 Construction and Control Joints

.1 Form construction and control joints in accordance with CSA A23.1 at the locations shown on the Drawings.

.2 Obtain approval from the Contract Administrator to place construction and control joints in locations other than where shown on the Drawings. Locate and make approved control joints to least impair strength of structure.

3.6 Sleeves and Inserts

.1 Cast in sleeves, anchors, frames, conduit, bolts, pipes and other inserts as shown on the Drawings. Obtain approval from the Contract Administrator to install sleeves and openings not shown on the Drawings that are greater than 100 millimetres x 100 millimetres in size.

3.7 Water stops

.1 Install water stops at the locations shown on the Drawings to provide a continuous water seal.

.2 Adequately secure water stops against displacement during concrete placing using methods that will not distort, pierce or hamper performance of the water stop or displace the steel reinforcement.

.3 Overlap water stops and make required field splices using equipment and methods recommended by the manufacturer.

3.8 Supply and Placing Concrete

.1 Provide 24 hours notice to the Contract Administrator before placing concrete to allow inspection and approval of steel reinforcement placement.

.2 Supply concrete from a ready-mixed concrete plant unless otherwise indicated in the Specifications or approved by the Contract Administrator. Concrete up to 0.5 cubic metres in volume may be hand mixed on site as approved by the Contract Administrator.

.3 Produce and deliver concrete to the Site in accordance with CSA A23.1 except transporting of ready-mixed concrete in non-agitating equipment will not be permitted without written permission from the Contract Administrator.

.4 Preheat concrete aggregate and water when placing concrete at or below a temperature of 5^{o}C or if the temperature will fall below 5^{o}C within 24 hours after placing concrete.

.5 Place ready-mixed concrete within 1 1/2 hours after introduction of mixing water to cement and aggregates unless the Contract Administrator approves an extension of time.

.6 Provide delivery tickets showing time of batching to the Contract Administrator before placing concrete.

.7 Add up to a maximum of 12 litres of additional water per cubic metre of concrete after initial mixing provided the measured slump of the concrete is less than specified in Table C 2160.1 and no more than 60 minutes have elapsed from the time of batching. Rotate the mixer drum a minimum of 30 revolutions at mixing speed after adding additional water.

.8 Place concrete in accordance with CSA A23.1 and additional requirements indicated in the Specifications.

.9 Allow the Contract Administrator to test the slump and air content before concrete is placed.

.10 Have the necessary equipment needed for adequate curing of the concrete on hand and ready for use before concrete placement begins.

.11 Remove excess water from excavations before placing concrete.

.12 Ensure reinforcement, forms and ground which concrete will come in contact with are free of frost.

.13 Place concrete at a rate that concrete remains plastic and flows readily into spaces between reinforcement. Concrete that has partially hardened or been contaminated by foreign material will not be allowed to be placed.

.14 Convey concrete as rapidly as possible from the mixer to final placement using methods that will prevent separation and loss of materials.

.15 Limit concrete free fall drop distance to not more than 1.5 metres. Use spouts or chutes approved by the Contract Administrator to place the concrete to prevent segregation of the concrete when free fall drop distance is greater than 1.5 metres.

.16 Use internal vibrators in accordance with CSA A23.1 to consolidate concrete placement. Do not use vibrators to move concrete. Form vibrators may be used when sections are too small for internal type of vibrator. Maintain at least one extra vibrator on site. Do not disturb concrete that has become too stiff to regain plasticity when vibrated. Do not apply vibration directly to steel reinforcement that extends into partially hardened concrete.

.17 Prepare existing concrete surfaces in accordance with CSA A23.1 where placing new concrete against existing concrete and apply approved bonding agent in accordance with manufacturer's recommendations.

.18 Thoroughly clean and wire brush exposed steel reinforcement surfaces of laitance, foreign matter and loose particles where existing steel reinforcement is to extend into new concrete.

3.9 Curing and Protection of Concrete

.1 Cure and protect concrete in accordance with CSA A23.1 and any additional requirements of the Specifications. Do not use curing compounds when a bond is required for subsequent topping or coating.

.2 Apply curing compound in accordance with manufacturer's recommendations. Completely coat and seal surface in one application.

.3 Maintain freshly placed concrete and surrounding air at a temperature of at least 10^{o} C for a period of 5 days after placing concrete in cold weather.

.4 Provide heating equipment as necessary to maintain the required air temperature in accordance with the following.

1 Use heating equipment that is not direct-fired.

2 Provide a chimney for venting heating equipment.

3 Locate heating equipment in a manner that will not endanger formwork or expose areas of concrete to drying out or other damage due to excessively high temperatures.

4 Apply heat continuously and uniformly for the required length of time.

3.10 Removal of Concrete Formwork

.1 Leave formwork in place until concrete has attained sufficient strength to adequately support its own weight and the construction loads likely to be applied. Remove forms for vertical surfaces no sooner than 24 hours after placing concrete provided the curing procedure in Section 3.9 of this specification is followed.

.2 Notify the Contract Administrator once the forms are removed for an inspection of the concrete surfaces. Provide a remedial work plan to the Contract Administrator for approval for repairing, recasting or repointing of damaged and broken concrete and surface imperfections identified in the inspection.

3.11 Concrete Finish

.1 Finish formed surfaces of underground structures in accordance with CSA A23.1 and as follows.

.1 Interior walls and exterior walls not exposed to view to have a rough-form finish.

.2 Above grade portions exposed to view to have a smooth form finish.

.2 Perform additional surface finish requirements in accordance with the Specifications.

.3 Float and screed top surface of slabs to profile and elevation in accordance with the Drawings. Sprinkling or dusting the surface with a dry mixture of cement or sand will not be permitted.

.4 Surface finishing of Type B) Structures listed in Table CW 2160.1 will not be required.

3.12 Waterproofing

.1 Waterproof the exterior surface of underground structures below grade in accordance with CAN/CGSB 37.3 and the waterproofing compound manufacturer's recommendations.

3.13 Corrective Action for Concrete Not Meeting Strength Requirements

.1 Perform one or more of the procedures outlined in CSA A23.1 as directed by the Contract Administrator if test results indicate concrete does not meet the strength requirements specified in Table CW 2160.1.

.2 Replace or strengthen those portions of the structure in a manner acceptable to the Contract Administrator that after performing the procedures outlined in CSA A23.1 still do not meet the specified strength requirements.

4. MEASUREMENT AND PAYMENT

4.1 Construction of Concrete Underground Structures

.1 Construction of concrete underground structure including formwork, steel reinforcement, sleeves and inserts, water stops, placing concrete, curing, finishing, waterproofing and related operations will be measured on a unit basis and paid for at the Contract Unit Price for "Concrete Underground Structure" of the type listed in the Schedule of Prices. The number of units to be paid for will be the total number of concrete underground structures constructed in accordance with this specification, accepted and measured by the Contract Administrator.

4.2 Concrete Testing

.1 Initial concrete testing performed in accordance with Section 2.17 of this specification will be paid for by the City.

.2 Additional concrete samples taken and testing performed in accordance with Section 3.13 of this specification for portions of concrete underground structures failing to meet the specified strength requirements will be at own expense.

4.3 Corrective Action for Concrete Not Meeting Strength Requirements

.1 Corrective action taken to replace or strengthen portions of concrete underground structures failing to meet the specified strength requirements will be at own expense.

CW 3010 – CLEARING AND GRUBBING

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CW 3010 - CLEARING AND GRUBBING

1. GENERAL CONDITIONS

The General Conditions and Standard Provisions attached hereto shall apply to and be a part of this Specification.

3. DESCRIPTION

This Specification shall cover the removal from the site of trees, stumps, roots, logs, brush, rubbish and all other surface litter within the full limits of the works, and the disposal of same in a manner hereinafter specified.

The work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies and all other things necessary for and incidental to the satisfactory performance and completion of all work as hereinafter specified.

9. CONSTRUCTION METHODS

Before commencement of any work, the Contractor shall consult with the Contract Administrator as to which trees and/or shrubs shall remain on site and be protected, if any. Those so designated shall be protected against damage from all construction activity.

The Contractor shall restrict his activities strictly to within the limits of the works, unless receiving prior written approval from the Contract Administrator. Trees are to be felled so as to land within the limits of the works. The Contractor shall take all precautions to prevent damage to traffic, structures, pole lines, adjacent property and to trees and shrubs designated to be saved, and he shall be liable for any damages occurring in the performance of this work.

The Contractor shall cut down all trees and shrubs, except those designated by the Contract Administrator to be saved, and grub out all stumps and roots. The Contractor shall load and haul all trees, stumps, roots, logs, brush, rubbish and all other surface litter from the site and dispose of these materials at dumps located by the Contractor and approved by the Contract Administrator. Any materials dropped or spilled on any streets during the hauling operations shall be promptly cleaned up by and at the expense of the Contractor, to the satisfaction of the Contract Administrator.

The Contractor shall ensure that upon completion of the clearing and grubbing operations the site shall be left free of any hazardous depressions and in a neat condition.

12. METHOD OF MEASUREMENT

Clearing and grubbing will be measured on an area basis. The area to be paid for shall be the total number of hectares within the limits of the works that are cleared and grubbed in accordance with this Specification acceptable to the Contract Administrator, as computed from measurements made by the Contract Administrator.

13. BASIS OF PAYMENT

Clearing and grubbing will be paid for at the Contract Unit Price per hectare for "Clearing and Grubbing", measured as specified herein, which price shall be payment in full for performing all operations herein described and all other items incidental to the work included in this Specification.

Winnipeg **PUBLIC WORKS DEPARTMENT • SERVICE DES TRAVAUX PUBLICS** **Engineering Division • Division de l'ingénierie**	**Effective Date:** February 28, 2020 **DIVISION 4**
CW 3110 – R21	**SUB-GRADE, SUB-BASE AND BASE COURSE CONSTRUCTION**

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1. DESCRIPTION

1.1 General

1.1.1 This specification covers pavement removal, excavation, preparation of sub-grade, supply and placement of sub-base and base course materials, ditch grading and boulevard grading for pavements, slab renewals, curbs, miscellaneous concrete slabs, sidewalks and other related works.

1.2 Definitions

1.2.1 Sub-grade – the natural in-situ material or imported material that has been used to build an embankment.

1.2.2 Sub-base layer – the layer of material between the sub-grade and the base course.

1.2.3 Base course layer – the layer of material between the sub-base and the pavement wearing surface.

1.2.4 Leveling course layer – a non-structural layer of base course material, up to 50mm in depth, placed immediately under the pavement wearing surface.

1.2.5 Granular A – open-graded virgin (not recycled) aggregates intended for use as free draining base and sub-base within the pavement structure.

1.2.6 Granular B – well-graded virgin or recycled aggregates intended for use as base and sub-base within the pavement structure. Granular A can be used instead of Granular B.

1.2.7 Granular C – dense graded virgin or recycled aggregates intended for use as base and sub-base. Granular A or B can be used instead of Granular C.

1.2.8 Crushed Recycled Concrete – aggregates obtained by recycling clean, hard, concrete waste. All types of contaminants, such as dirt, plaster, gypsum and other building waste, must be removed.

1.2.9 Deleterious Material – soft material that would decay or disintegrate from weathering, porcelain, vegetation, organic material, wood, glass, plastic, metal, reinforcing steel, building rubble, brick, shale, and friable particles.

1.3 Referenced Standard Construction Specifications

1.3.1 CW 1130 – Work Site Requirements.

1.3.2 CW 3130 – Supply and Installation of Geotextile Fabrics.

1.3.3 CW 3450 – Planing of Pavement.

2. MATERIALS

2.1 General

2.1.1 Effective July 1st, 2020, the City of Winnipeg, Research and Standards Engineer will maintain a list of approved aggregate suppliers. To obtain approval, aggregate suppliers must annually submit the following information to the Research and Standards Engineer prior to April 1st:

2.1.1.1 Aggregate Suppliers Approval Guidelines and Application;

2.1.1.2 Quality control program for all materials, including a proposed sampling and testing plan with minimum sampling and testing frequencies in accordance with Section 4;

2.1.1.3 The laboratory(s) to be used and its credentials;

2.1.1.4 The quality control personnel and their qualifications;

2.1.1.5 Course of action for disposal or rework of materials that do not meet this specification; and,

2.1.1.6 Frequency of production equipment inspection, verification of calibration, and any certification of the production facility.

2.1.2 The Aggregate Suppliers Approval Guidelines and Application and the list of approved aggregate suppliers are available at the City of Winnipeg, Corporate Finance, Material Management Division website at:
https://www.winnipeg.ca/matmgt/Spec/Default.stm

2.1.3 The City of Winnipeg, Research and Standards Engineer will conduct inspections at least once a year during production. Samples of materials may be taken and tested.

2.2 Base Course and Sub-Base Materials

2.2.1 Base course and sub-base materials shall conform to the following requirements:

2.2.1.1 Base course and sub-base materials will be of a type approved by the Contract Administrator.

2.2.1.2 Base course and sub-base materials shall be sound, durable particles produced by crushing, screening and grading of recovered materials.

2.2.1.3 Base course and sub-base materials shall conform to the grading requirements in Table CW 3110.1 and the physical requirements in Table CW 3110.2.

TABLE CW 3110.1 - Gradation Requirements

Canadian Metric Sieve Size	Percent Of Total Dry Weight Passing Each Sieve								
	Granular A*			Granular B**			Granular C**		
	Base Course	50 mm	100 mm	Base Course	50 mm	100 mm	Base Course	50 mm	100 mm
125 000			100%			100%			100%
100 000			85% - 100%			85% - 100%			97% - 100%
75 000			70% - 92%			--			--
50 000		100%	50% - 75%		100%	50% - 80%		100%	--
37 500		75% - 95%	--		75% - 95%	--		--	--
25 000	100%	50% - 84%	25% - 55%	100%	55% - 85%	30% - 60%		--	30% - 50%
20 000	85% - 95%	--	--	85% - 95%	--	--	100%	--	--
10 000	50% - 78%	25% - 60%	15% - 40%	50% - 78%	30% - 65%	20% - 45%	--	--	--
5 000	35% - 60%	18% - 48%	--	--	--	--	40% - 70%	25% - 60%	--
2 500	20% - 48%	--	--	20% - 48%	--	--	25% - 60%	--	--
1 250	12% - 34%	10% - 32%	6% - 22%	--	12% - 38%	8% - 25%	--	--	--
630	8% - 26%	--	--	8% - 28%	--	--	--	--	--
315	5% - 18%	5% - 20%	3% - 14%	5% - 20%	5% - 22%	4% - 15%	8% - 25%	--	--
80	2% - 8%	2% - 8%	2% - 8%	2% - 8%	2% - 8%	2% - 8%	6% - 17%	4% - 15%	0% - 8%

TABLE CW 3110.2 - Physical Property Requirements

Tests	Testing Method	Granular A			Granular B			Granular C		
		Base Course	50 mm	100 mm	Base Course	50 mm	100 mm	Base Course	50 mm	100 mm
Los Angeles Abrasion, % maximum	ASTM C535 (Grading 1)	--	--	35	--	--	35	--	--	--
Los Angeles Abrasion, % maximum	ASTM C131 (Grading A)	--	35	--	--	35	--	--	--	--
Los Angeles Abrasion, % maximum	ASTM C131 (Grading B)	35	--	--	35	--	--	--	--	--
California Bearing Ratio (CBR)* - 4 days soaked, % minimum @ 2.54 mm	ASTM D1883	80	80	--	60	60	--	--	--	--
Micro-Deval Abrasion, % maximum	ASTM D6928	15	15	15	17	17	17	20	20	20
Percentage of Fractured Particles, minimum two or more fractured faces, % mass**	ASTM D5821	80	80	70	70	70	60	--	--	--
Liquid Limit,% maximum** Plasticity Index,% maximum**	ASTM D4318	20 Non plastic	22 Non plastic	22 Non plastic	22 Non plastic	22 4	25 6	25 6	25 6	25 6
Content Composition, maximum**	Mass %	--			10% asphalt material 3% clay 3% deleterious materials			15% asphalt material 3% clay 3% deleterious materials		

*CBR test shall be performed at 100 % maximum dry unit weight and optimum water content. A shorter immersion period (24 hr) is permissible for virgin aggregates that take up moisture readily if tests show that the shorter period will not affect the results.

**Percentage of Fractured Particles, Atterberg Limits, and Content Composition are not required for crushed limestone materials. Content Composition shall be performed on materials retained on 5000 µm sieve and above.

2.3 Lime or Portland Cement

2.3.1 Use either Lime or General Use Cement for drying the sub-grade.

2.3.2 Supply Lime in accordance with CSA A82.43.

2.3.3 Supply Portland Cement in accordance with CSA.

2.4 Imported Fill Material

2.4.1 Imported fill material will be of a type approved by the Contract Administrator. Saturated clay and organic soils will not be permitted.

2.4.2 The fill material shall be free of unsuitable or deleterious materials, such as tree roots, branches, stumps, sludge, metal, trash, wood, vegetation or rubble.

3. CONSTRUCTION METHODS

3.1 Pavement Removal

3.1.1 Remove existing concrete pavement, including curbs and asphalt overlays at locations as shown on the Drawings or as directed by the Contract Administrator. Remove all pavements to a combined thickness of 300 millimetres, unless otherwise indicated in the Specifications.

3.1.2 Remove existing asphalt pavement including asphalt curbs at locations as shown on the Drawings or as directed by the Contract Administrator. Remove pavement to a maximum thickness of 150 millimetres, unless otherwise indicated in the Specifications.

3.1.3 Saw-cut the existing pavement full-depth along the limits designated for removal.

3.1.4 Utilize backhoe type equipment unless approved otherwise by the Contract Administrator.

3.1.5 Dispose of material in accordance with Section 3.4 of CW 1130.

3.2 Excavation

3.2.1 Excavate site material to the depth that accommodates the pavement structure as shown on the Drawings or as directed by the Contract Administrator.

3.2.2 Stockpile suitable sub-grade material and suitable site sub-base material at locations on site as directed by the Contract Administrator.

3.2.3 Dispose of surplus suitable site material and unsuitable material such as frost heaving clays, silts, rocks and rubble in accordance with Section 3.4 of CW 1130.

3.2.4 Strip and stockpile topsoil from the site in a manner which will prevent contamination of topsoil with underlying soil materials. Stockpile the stripped topsoil at locations on site for later use.

3.2.5 The limits of excavation will be taken as a vertical plane 450 millimetres beyond the limits of the proposed pavement except when slip form paving equipment is specified for placement of the concrete pavement, the limits of excavation will be increased to a vertical plane 750 millimetres beyond the limits of the proposed pavement.

3.2.6 During excavation, the Contractor will be advised by the Contract Administrator as to which areas have an unsuitable sub-grade.

3.2.7 Remove wooden poles, concrete bases, or tree stumps encountered under pavements to the top of subgrade or 1 metre below the bottom of the pavement surface, whichever depth is greater.

3.2.8 Backfill and compact over-excavated areas with sub-base material approved by the Contract Administrator.

3.2.9 Excavate additional material beyond the boulevard grading and ditch grading limits as directed by the Contract Administrator.

3.3 Preparation of Sub-grade and Placement of Sub-base Material

3.3.1 Compact the sub-grade after the bottom of the excavation has been approved by the Contract Administrator.

3.3.2 Compact areas of suitable sub-grade material, the full width of the excavation, to a minimum of 95% Standard Proctor Maximum Dry Density.

3.3.3 If the sub-grade material cannot be compacted to the required density, the Contractor shall proceed as directed by the Contract Administrator.

3.3.4 The stability and uniformity of compaction may be checked by proof rolling the sub-grade. Proof rolling procedures and acceptance shall be in accordance with the following:

3.3.4.1 The roller shall be either a tandem-axle rear dump truck or a tri-axle rear dump truck (with raised third axle) loaded to a minimum gross weight of 30 tonnes. The Contractor may, with the approval of the Contract Administrator, use alternate equipment that produces similar results;

3.3.4.2 Tire pressure shall be no less than 90 percent of the manufacturer's recommended maximum inflation;

3.3.4.3 Operate the equipment between 4.0 and 8.0 km/hr;

3.3.4.4 Proof rolling must be carried out the same calendar day that compaction is completed; otherwise the surface must be watered and given a minimum of three passes with the roller prior to the commencement of proof rolling; and,

3.3.4.5 Rutting in excess of 40 mm shall not be accepted and the layer shall be reworked and compacted to the required density. Where the rutting exceeds 150 mm, proceed as directed by the Contract Administrator. No substantial surface cracking or lateral movement of the layer shall be allowed.

3.3.5 Sub-base material shall not be placed if there is frost present within 600 mm of the surface upon which it is being placed.

3.3.6 Place and compact sub-base material with geotextile fabric and/or geogrid in accordance with Sections 3.4 and 3.5.

3.3.7 Place and compact suitable site sub-base material before placing any new sub-base material as directed by the Contract Administrator.

3.3.8 Place and compact sub-base materials in layers to a minimum depth of 3 times the maximum aggregate size unless otherwise shown on the Drawings or as directed by the Contract Administrator. Compact to a minimum of 100% Standard Proctor Maximum Dry Density, for the full width of the excavation, and each layer must be leveled and approved by the Contract Administrator before the succeeding layer may be placed.

3.3.9 Where Field Density Tests cannot be performed, check the stability and uniformity of compaction by proof rolling the sub-base. Proof rolling procedures shall be in accordance with Section 3.3.4 of this Specification. Rutting in excess of 15 mm shall not be accepted and the layer shall be reworked and compacted to the required density. Where the rutting exceeds 150 mm, proceed as directed by the Contract Administrator. No substantial surface cracking or lateral movement of the layer shall be allowed.

3.3.10 Recompact or replace any layer which has been rejected as directed by the Contract Administrator.

3.3.11 When excess water has been applied, either by sprinkling operations or by precipitation, to cause local or continuous pondage, soil compaction will not be permitted until sufficient soil drying has occurred, creating a condition lending itself favourably to compacting operations. Exercise necessary precautions to protect compacted areas against excess wetting from any natural or artificial sources of water application.

3.3.12 Should excess moisture from continuous or heavy precipitation threaten to unduly delay the completion of the Contract, apply in writing to the Contract Administrator requesting permission to use Lime or Portland Cement to dry out the clay sub-grade or sub-base material at specific location(s).

3.3.13 Mixing or blending of sub-base materials will not be permitted.

3.4 Placement of Sub-Base Material with Geotextile Fabric

3.4.1 Install separation or separation/filtration or stabilization geotextile fabric in accordance with CW 3130.

3.4.2 For sub-grades with CBR ≥ 3.0%, place and compact a minimum of 150 mm of sub-base material over the geotextile fabric prior to allowing construction traffic to travel on the sub-base.

3.4.3 For subgrades with CBR < 3.0%, place and compact a minimum of 300 mm of sub-base material over the geotextile fabric prior to allowing construction traffic to travel on the sub-base unless otherwise shown on the Drawings or as directed by the Contract Administrator. The minimum lift thickness may need to be increased for very weak subgrade material to prevent spreading equipment from damaging the geotextile fabric.

3.4.4 Place sub-base material by end-dumping methods and level with equipment as approved by the Contract Administrator to avoid damage to the geotextile fabric and minimize sub-grade failures. No sheep-foot type equipment will be allowed on the first lift. In no case shall material be dropped on uncovered geotextile from a height of more than 1 m.

3.4.5 Direct traffic on the geotextile, along with any sudden stops, starts, or turns on the first lift by construction equipment, shall not be allowed.

3.4.6 Construction traffic will not be allowed to travel on the placed sub-base material until approved by the Contract Administrator.

3.5 Placement of Sub-base Material with Geotextile Fabric and Geogrid

3.5.1 Prepare the subgrade in accordance with Section 3.3 of this Specification.

3.5.2 Supply and install geotextile fabric over the subgrade in accordance with CW 3130 and Section 3.4 of this Specification.

3.5.3 Supply and install geogrid in accordance with CW 3135.

3.5.4 Place sub-base material by end dumping down the centre of the excavation. The sub-base shall be pushed forward and levelled using a track type dozer where possible, to build a thickened section to support the hauling operations and avoid damage to the subgrade, geotextile fabric or geogrid. This procedure shall continue until all sub-base material has been placed down the centre of the excavation.

3.5.5 Spread the sub-base material to facilitate final grades utilizing a track type dozer.

3.5.6 Initial compaction of the sub-base material shall be completed utilizing vibratory type equipment capable of compacting the material. The additional compaction shall be completed utilizing static type equipment. No trucks, rubber tire loaders or graders will be allowed to travel on the sub-base material until the Contract Administrator has approved the compaction of the sub-base.

3.6 Placement of Base Course Material

3.6.1 Base course material shall not be placed if there is frost present within 600 mm of the surface upon which it is being placed.

3.6.2 Place and compact base course material to a minimum depth of 3 times the maximum aggregate size unless otherwise shown on the Drawings or as directed by the Contract Administrator. Compact to a minimum of 100% Standard Proctor Maximum Dry Density, for the full width of the excavation, and each layer must be leveled and approved by the Contract Administrator before the succeeding layer may be placed.

3.6.3 Level the compacted base course to the finished base course elevation.

3.6.4 Maintain the finished base course until the pavement is placed.

3.6.5 Spread base course material uniformly to avoid segregation, free of pockets of fine and

coarse material.

3.6.6 Place and compact leveling course to a maximum thickness of 50 millimetres for sidewalks, renewal of existing curbs and miscellaneous concrete slabs, to 95% Standard Proctor Maximum Dry Density.

3.6.7 Place and compact base course material immediately beneath pavement and forms to provide firm support.

3.7 Placement of Imported Fill

3.7.1 Place imported fill materials to satisfy the grading requirements of boulevard and ditches.

3.7.2 Supply material in accordance with Section 2.4 of this specification.

3.7.3 Compact to a minimum of 95% Standard Proctor Maximum Dry Density.

3.7.4 Imported fill shall be free of frozen lumps and shall be placed and compacted in an unfrozen state. Imported fill shall not be placed if there is frost present within 600 mm of the surface upon which it is being placed.

3.8 Grading of Boulevards

3.8.1 Grading of the boulevards and medians to receive sod will be understood to mean the required excavation or backfilling to a depth up to 150 millimetres so that the boulevards and medians, after compaction, are at a uniform depth of 100 millimetres below finished boulevard grade, as shown on the Drawings.

3.8.2 Remove all debris, stones and concrete rubble from the boulevards and medians before commencing grading.

3.8.3 Grade the boulevards and medians to receive sod, unless otherwise shown on the Drawings or as directed by the Contractor Administrator.

3.8.4 Remove all debris, stones and concrete rubble from the boulevards and medians before commencing grading.

3.8.5 Excavate to a depth of up to 150 millimetres to meet the final grade 100 millimetres below finished boulevard grade.

3.8.6 Place and compact suitable backfill material as approved by the Contract Administrator to a depth of up to 150 millimetres to meet the final grade 100 millimetres below finished boulevard grade.

3.8.7 Supply backfill material in accordance with Section 2.4 of this specification.

3.8.8 Compact backfill materials to a minimum of 95% Standard Proctor Maximum Dry Density.

3.9 Grading of Ditches

3.9.1 Grading of ditches will be understood to mean the required excavation or backfilling to a depth up to 300 millimetres so that the ditches, after compaction are at finished grade where no sodding is required or at a uniform depth of 100 millimetres below finished grade where sodding is required.

3.9.2 Grade ditches as shown on the Drawings or as directed by the Contract Administrator.

3.9.3 Excavate to a depth of up to 300 millimetres to meet the final ditch grade requirements.

3.9.4 Place and compact suitable backfill material as approved by the Contract Administrator to a depth of up to 300 millimetres to meet the final ditch grade requirements.

3.9.5 Supply backfill material in accordance with Section 2.4 of this specification.

3.9.6 Compact backfill materials to a minimum of 95% Standard Proctor Maximum Dry Density.

3.10 Quality Control of Sub-grade, Sub-base and Base Course Layers

3.10.1 Utilize quality control tests to determine the acceptability of the sub-grade, sub-base and base course layers, as placed and compacted before the succeeding layer may be applied.

3.10.2 Promptly fill holes made by sampling with appropriate material and thoroughly compact to conform with the adjoining material.

3.11 Removal of Existing Concrete Bases

3.11.1 Remove existing concrete bases as shown on the Drawings or as directed by the Contract Administrator.

3.11.2 Remove to a depth of 1.0 metre below finished grade.

3.11.3 Dispose of material in accordance with Section 3.4 of CW 1130.

3.11.4 Backfill holes remaining with base course material and compact to the satisfaction of the Contract Administrator.

4. QUALITY CONTROL TESTING

4.1 All materials supplied under this Specification shall be subject to quality control testing and approval by the City of Winnipeg, Research and Standards Engineer. The testing shall be carried out by qualified and certified testing facilities.

4.2 The quality control program shall include Gradation, Los Angeles Abrasion, Micro-Deval Abrasion, CBR, Percentage of Fractured Particles, Content Composition, Liquid Limit and Plasticity Index in accordance with Section 2 of this Specification.

4.3 The frequency of quality control testing for base course and sub-base materials during production shall be in accordance with Table CW 3110.3.

TABLE CW 3110.3 – Quality Control Testing Frequency During Production

	Granular A		Granular B				Granular C			
			Virgin Aggregates		Recycled Aggregates		Virgin Aggregates		Recycled Aggregates	
	Gradation	Physical Properties	Gradation	Physical Properties	Gradation	Physical Properties	Gradation	Physical Properties	Gradation	Physical Properties
Base course	2000 tonnes	5000 tonnes	2000 tonnes	5000 tonnes	2000 tonnes	3000 tonnes	2000 tonnes	5000 tonnes	2000 tonnes	3000 tonnes
50 mm	3000 tonnes	10000 tonnes	3000 tonnes	8000 tonnes	3000 tonnes	4000 tonnes	3000 tonnes	10000 tonnes	4000 tonnes	5000 tonnes
100 mm	4000 tonnes	10000 tonnes	4000 tonnes	10000 tonnes	4000 tonnes	5000 tonnes	4000 tonnes	10000 tonnes	5000 tonnes	8000 tonnes

4.4 Quality control information shall be submitted bi-weekly to, and will be monitored by, the City of Winnipeg, Research and Standards Engineer.

5. QUALITY ASSURANCE TESTING

5.1 The Contractor shall not deliver materials to site prior to approval of the Contract Administrator.

5.2 The Contract Administrator shall ensure that a minimum of one sample of base course and sub-base materials are tested prior to starting construction in accordance with Section 2. The Contract Administrator shall ensure that the materials are sampled in accordance with ASTM D75 Standard Practice for Sampling Aggregates.

5.3 If one test fails to meet the requirements of this Specification, the material shall be re-tested. If the material fails again, the Contractor shall designate a new material source. The Contractor shall reimburse the City for any additional costs the City incurs as a result of failed tests.

5.4 The Contract Administrator shall confirm that materials delivered to site are equal to or better than the materials tested prior to construction by sampling from site and testing in accordance with Section 2. The Contract Administrator shall be present to witness that the sampling is in accordance with ASTM D75 Standard Practice for Sampling Aggregates. Where required, the Contractor shall provide all necessary equipment or personnel to aid in the sampling.

5.5 The Contractor shall provide a weekly estimate of the material supplied to the Contract Administrator.

5.6 The Contract Administrator shall ensure the minimum frequency of quality assurance testing for base course and sub-base materials during construction is in accordance with Table CW 3110.4. Where less than 200 tonnes of base course or 500 tonnes of sub-base materials are expected, quality assurance testing may not be required by the Contract Administrator.

TABLE CW 3110.4 – Quality Assurance Testing Frequency During Construction*

	Granular A	Granular B		Granular C	
		Virgin Aggregates	Recycled Aggregates	Virgin Aggregates	Recycled Aggregates
Base course	3000 tonnes	2500 tonnes	1500 tonnes	3000 tonnes	2000 tonnes
50 mm	5000 tonnes	4000 tonnes	2500 tonnes	5000 tonnes	3000 tonnes
100 mm	10000 tonnes	8000 tonnes	5000 tonnes	8000 tonnes	5000 tonnes

***The minimum testing frequency for each size shall be one sample.

5.7 The quality assurance program shall include Gradation, Los Angeles Abrasion, Micro-Deval Abrasion, Percentage of Fractured Particles, Content Composition, Liquid Limit and Plasticity Index in accordance with Section 2 of this Specification. Los Angeles Abrasion is not required for base course and 50mm materials. For 100mm materials, the Contract Administrator should ensure there is sufficient quantity to run two gradation tests.

5.8 If the material fails consecutive tests or when a change in the properties of the materials occurs, the use of the materials shall be discontinued until the Contractor proves the source to be satisfactory. The Contractor shall reimburse the City for any costs the City incurs as a result of failed tests.

5.9 The Contract Administrator shall apply a pay adjustment in accordance with Tables CW 3110.5 and CW 3110.6 against the entire quantity represented by the failed test(s) for materials that have already been placed and compacted. The quantity represented by the failed tests is the material supplied after sampling associated with the initial failed test.

TABLE CW 3110.5 - Pay Adjustment for Percent Passing Outside Specified Limits for Gradation Requirements Based on Average of the Failed Consecutive Tests

Percent Passing Outside Specified Limits for Sieves					Percent of Price Reduction %
125000,100000, 75000, 50000	37500, 25000	20000, 10000	5000, 2500	1250, 630, 315, 80	
<2	<2	<2	<1	--	0%
2	2	2	1	<1	0%
3	3-4	3-4	2	1.5	0%
4	5	5	3	2	0%
>4	>5	>5	>3	>2	Remove materials, including those that have already been placed and compacted.

TABLE CW 3110.6 - Pay Adjustment for Percent Passing Outside Specified Limits for Physical Property Requirements Based on Average of the Failed Consecutive Tests

Los Angeles Abrasion	Micro-Deval Abrasion	Percentage of Fractured Particles	Atterberg Limits	Percent of Price Reduction %
<3	<1	<5	<2	0%
3-4	1	5-7	2	0%
5	2	8	3	0%
>5	>2	>8	>3	Remove materials, including those that have already been placed and compacted.

5.10 The pay adjustment will be the maximum price reduction or removal requirement identified in accordance with Tables CW3110.5 and CW3110.6

5.11 The Contract Administrator shall be allowed access to all sampling locations and reserves the right to take samples for testing at any time.

5.12 When more than one source is used for supplying materials, test data from each source and material shall be managed independently. The Contractor shall reimburse the City for any additional costs the City incurs as a result of using multiple sources.

5.13 The Contractor shall provide written notification to the Contract Administrator prior to changing the aggregate source or type. The Contractor shall reimburse the City for any additional costs the City incurs as a result of the change.

5.14 Determine the Standard Proctor Maximum Dry Density for the sub-grade, sub-base and base course materials at the optimum moisture content in accordance with ASTM Standard D698. The test frequency shall follow the frequency in Section 5.6 and the Maximum Dry Density shall be the average for each material. The field density of each sub-grade, sub-base and base course layer will be a percentage of the Standard Proctor Maximum Dry Density, in Sections 3.3, 3.4, 3.5 and 3.6 of this Specification.

5.15 Verify the field density of the compacted layers by Field Density Tests in accordance with ASTM Standard D6938, Standard Test Methods for In-Place Density and Water Content of Soil and Soil Aggregate by Nuclear Methods (Shallow Depth).

5.16 The Contract Administrator shall ensure the frequency of field density tests during construction is as follows:

5.16.1 For projects less than 2000 square meters: one field density test every 300 square meters with a minimum of three (3) tests per material.

5.16.2 For projects greater than 2000 square meters: one field density test every 500 square meters per material.

5.17 The Contract Administrator shall offset the field density tests as appropriate to provide coverage across the full width of the construction area.

5.18 If a density test result is less than the required density, the area shall be reworked and retested. The Contractor shall reimburse the City for any additional costs the City incurs as a result of failed tests.

5.19 Field density tests must be carried out the same calendar day that compaction is completed; otherwise the surface must be watered and given a minimum of three passes with the roller prior to testing.

5.20 Testing in addition to the requirements of this Specification shall be as directed by the Contract Administrator.

5.21 There shall be no charge for any materials taken for testing purposes.

6. MEASUREMENT AND PAYMENT

6.1 Pavement Removal

6.1.1 Pavement removal will be measured on an area basis and paid for at the Contract Unit Price per square meter for the "Items of Work" listed here below. The area to be paid for will be the total number of square metres of existing pavement removed in accordance with this specification, accepted and measured by the Contract Administrator.

Items of Work:

Pavement Removal
i.) Concrete Pavement
ii.) Asphalt Pavement

6.1.2 Disposal of material will be included in the payment for the "Items of Works" listed for pavement removal.

6.1.3 Curb and asphalt overlay will be included in the payment for the Item of Work if both are removed in one operation with the pavement.

6.1.4 Payment for pavement over 300mm in thickness will be paid in ratio to the thickness over 300mm.

6.2 Stripping and Stockpiling Topsoil

6.2.1 Stripping and stockpiling topsoil will be measured on a volume basis and paid for at the Contract Unit Price per cubic metre for "Stripping and Stockpiling Topsoil". The volume to be paid for will be the total number of cubic metres of existing topsoil stripped and stockpiled in accordance with this specification, accepted and measured by the Contract Administrator.

6.3 Excavation

6.3.1 Excavation will be measured on a volume basis and paid for at the Contract Unit Price per cubic metre for "Excavation". The volume to be paid for will be the total number of cubic metres excavated in accordance with this specification, accepted and measured by the Contract Administrator.

6.3.2 The volume of excavation will be measured by cross-sections in its original position and computed by the method of Average End Areas.

6.3.3 Only material excavated within the limits of excavation will be included in the payment for "Excavation".

6.3.4 Disposal of material, removal of miscellaneous trees, shrub and concrete bases unless otherwise indicated in the Specifications, will be included in payment for "Excavation".

6.3.5 Excavation of solid bedrock, glacial till, boulders, loose rock, concrete rubble and foundations which are located within the limits of excavation and which require the use of additional or unconventional excavation equipment will be measured and paid for in addition to the unit price for excavation.

6.4 Sub-grade Compaction

6.4.1. Sub-grade compaction will be measured on an area basis and paid for at the Contract Unit Price per square metre for "Sub-Grade Compaction". The area to be paid for will be the total number of square metres of sub-grade compacted in accordance with this specification, accepted and measured by the Contract Administrator.

6.5 Sub-grade Material

6.5.1 Suitable Site Sub-grade Material

6.5.1.1 The supplying, placing and compaction of suitable site sub-grade material will be measured on a volume basis and paid for at the Contract Unit Price per cubic metre for "Supplying and Placing Suitable Site Sub-grade Material". The volume to be paid for will be the total number of cubic metres of material compacted in place in accordance with this specification, accepted and measured by the Contract Administrator.

6.5.1.2 The volume of suitable site sub-grade material will be measured by cross-sections and computed by the method of Average End Areas.

6.5.1.3 Only material placed within the limits of excavation will be included in the payment for "Supplying and Placing Suitable Site Sub-grade Material".

6.5.1.4 No measurement or payment will be made for materials rejected by the Contract Administrator.

6.5.2 Imported Fill Material

6.5.2.1 Imported fill material will be measured on a volume basis and paid for at the Contract Unit Price per cubic metre for "Imported Fill Material". The volume to be paid for will be the total number of cubic metres of imported fill material supplied and placed in accordance with this specification, accepted and measured by the Contract Administrator.

6.5.2.2 The volume of imported fill material will be computed from cross-sections by the method of Average End Areas.

6.5.2.3 No measurement or payment will be made for materials rejected by the Contract Administrator.

6.6 Sub-base Material

6.6.1 Suitable Site Sub-base Material

6.6.1.1 The reloading, hauling, placing and compaction of suitable site sub-base material will be measured on a volume basis and paid for at the Contract Unit Price per cubic metre for "Placing Suitable Site Sub-base Material". The volume to be paid for will be the total number of cubic metres of suitable site sub-base material placed in accordance with this specification, accepted and measured by the Contract Administrator.

6.6.1.2 The volume of suitable sub-base material will be measured by cross-sections and computed by the method of Average End Areas.

6.6.1.3 Only material placed within the limits of excavation will be included in the payment for "Placing Suitable Site Sub-base Material".

6.6.1.4 No measurement or payment will be made for materials rejected by the Contract Administrator.

6.6.2 Sub-base Material

6.6.2.1 The supplying, placing and compaction of sub-base material will be measured on a weight basis and paid for at the Contract Unit Price per tonne for the "Supplying and Placing Sub-base Material*" listed here below. The weight to be paid for will be the total number of tonnes of sub-base material supplied and placed in accordance with this specification, accepted and measured by the Contract Administrator.

Items of Work:

i.) 50 mm Granular A*
ii.) 50 mm Granular B*
iii.) 50 mm Granular C*
iv.) 100 mm Granular A*
v.) 100 mm Granular B*
vi.) 100 mm Granular C*

*Sub-base material may be specified.

6.6.2.2 The weight to be paid for will be the total number of tonnes of sub-base material as measured on a certified weigh scale.

6.6.2.3 Only material placed within the limits of excavation will be included in the payment for the "Items of Work" listed for sub-base material.

6.6.2.4 No measurement or payment will be made for materials rejected by the Contract Administrator.

6.7 Base Course Material

6.7.1 The supplying, placing and compaction of base course material will be measured on a volume basis and paid for at the Contract Unit Price per cubic metre for the "Supplying and Placing Base Course Material*". The volume to be paid for will be the total number of cubic metres of base course material supplied and placed in accordance with this specification, accepted and measured by the Contract Administrator.

Items of Work:

i.) Base Course Material - Granular A*
ii.) Base Course Material - Granular B*
iii.) Base Course Material - Granular C*

*Base course material may be specified.

6.7.2 The volume of base course material will be measured by cross-sections and computed by the method of Average End Areas.

6.7.3 Only material placed within the limits of excavation will be included in payment for "Supplying and Placing Base Course Material".

6.7.4 No measurement or payment will be made for materials rejected by the Contract Administrator.

6.8 Leveling Course

6.8.1 No payment will be made for leveling course.

6.9 Grading of Boulevards

6.9.1 The grading of boulevards will be measured on an area basis and paid for at the Contract Unit Price per square metre for "Grading of Boulevards". The area to be paid for will be the total number of square metres of boulevards graded in accordance with this specification, accepted and measured by the Contract Administrator.

6.9.2 Additional excavation over 150 millimetres in depth required to complete boulevard grading will be paid for as "Boulevard Excavation".

6.9.3 Additional placement of backfill material over 150 millimetres in depth required to complete boulevard grading will be paid as "Imported Fill Material".

6.10 Ditch Grading

6.10.1 Ditch grading will be measured on an area basis and paid for at the Contract Unit Price per square metre for "Ditch Grading". The area to be paid for will be the total number of square metres of ditch graded in accordance with this specification, accepted and measured by the Contract Administrator.

6.10.2 Additional excavation over 300 millimetres in depth required to complete the ditch grading will be paid for as "Ditch Excavation".

6.10.3 Additional placement of backfill material over 300 millimetres in depth required to complete the ditch grading will be paid as "Imported Fill Material".

6.11 Boulevard Excavation

6.11.1 Boulevard excavation will be measured on a volume basis and paid for at the Contract Unit Price per cubic metre for "Boulevard Excavation". The volume to be paid for will be the total number of cubic metres of boulevard excavated in accordance with this specification, accepted and measured by the Contract Administrator.

6.11.2 The volume of excavation will be as measured by cross-sections in its original position and computed by the method of Average End Areas.

6.12 Ditch Excavation

6.12.1 Ditch excavation will be measured on a volume basis and paid for at the Contract Unit Price per cubic metre for "Ditch Excavation". The volume to be paid for will be the total number of cubic metres of ditches excavated in accordance with this specification, accepted and measured by the Contract Administrator.

6.12.2 The volume of excavation will be as measured by cross-sections in its original position and computed by the method of Average End Areas.

6.13 Removal of Existing Concrete Bases

6.13.1 Removal of existing concrete bases will be measured on a unit basis and paid for at the Contract Unit Price per unit for the "Items of Work" listed here below. The number of units to be paid for will be the total number of existing concrete bases removed in accordance with this specification, accepted and measured by the Contract Administrator.

Items of Work:

Removal of Existing Concrete Bases
- i.) 600 mm Diameter or Less
- ii.) Greater than 600 mm Diameter

6.13.2 No measurement or payment will be made for concrete bases removed for parking metres and precast concrete bases for traffic signs.

6.14 Lime or Portland Cement

6.14.1 Lime for drying the sub-grade will be measured on a weight basis and paid for at the Contract Unit Price per tonne for "Supplying and Placing Lime". The weight to be paid for will be the total number of tonnes of Lime supplied and placed in accordance with this specification, accepted and measured by the Contract Administrator.

6.14.2 Portland Cement for drying the sub-grade will be measured on a weight basis and paid for at the Contract Unit Price per tonne for "Supplying and Placing Portland Cement". The weight to be paid for will be the total number of tonnes of Portland Cement supplied and placed in accordance with this specification, accepted and measured by the Contract Administrator.

6.14.3 The weight to be paid for will be the total number of tonnes of Lime or Portland Cement as measured on a certified weigh scale.

PUBLIC WORKS DEPARTMENT • SERVICE DES TRAVAUX PUBLICS Engineering Division • Division de l'ingénierie	**Effective Date:** January 28, 2020 **DIVISION 4**
CW 3130 – R5	**SUPPLY AND INSTALLATION OF GEOTEXTILE FABRICS**

TABLE OF CONTENTS

1. DESCRIPTION

1.1 General

1.1.1. This specification covers the supply and installation of Separation (slit-tape or slit-film woven), Separation/Filtration (nonwoven), and Subgrade Stabilization fabrics relating to Surface Works construction.

1.1.2. All property values, with the exception of apparent opening size, represent minimum average roll values (MARV) in the weakest principle direction. Values for apparent opening size represent maximum roll values.

1.2 Definitions

Nonwoven Geotextile:	A planar geosynthetic made of randomly orientated yarns produced by bonding fibres, or interlocking fibres, or both bonding and interlocking fibres by mechanical, chemical, or thermal means.
Slit-Tape / Slit-Film Woven Geotextile:	A planar geosynthetic made from flat, tape-like yarns that are produced by slitting and extruded film. Unsuitable for applications in which high groundwater or moderate to high moisture contents are present.
Multi-Filament Fibrillated Yarn High Strength Woven Geotextile:	A planar woven geotextile made from high-tenacity long-chain synthetic polymers composed of at least 95 percent by weight polyolefins. They shall form a stable network such that the filaments or yarns retain their dimensional stability relative to each other, including selvages.
Minimum Average Roll Value (MARV):	Property value calculated as typical minus two standard deviations. It shall yield a 97.7 percent degree of confidence that any sample taken during quality assurance testing will exceed value reported.
Typical Value (TV):	The mean value calculated from documented manufacturing quality control test results for a defined population obtained from one test method associated with one specific property.
Minimum Value (MV):	The lowest sample value from documented manufacturing quality control test results for a defined population from one test method associated with one specific property.
Separation:	A geosynthetic function in which a geotextile is used to prevent mixing of two dissimilar materials to maintain their engineering properties such as a subgrade soil and an aggregate cover.
Filtration:	A geosynthetic function in which a geotextile is placed between two dissimilar soils to allow for long-term passage of water into a subsurface drainage system and retain the in-situ soil.

Reinforcement:	A geosynthetic function in which a geotextile acts as a tensile member in the surface structure of a pavement.
Confinement:	A geosynthetic function in which a geosynthetic prevents the lateral movement (rutting) of aggregate.
Stabilization:	The use of a geosynthetic or combination of geosynthetics and geogrid on weak to very weak subgrade conditions (CBR ≤ 3.0%) to provide the coincident functions of separation, filtration, reinforcement, and confinement.
California bearing ratio (CBR)	Standard test method for evaluation the potential strength of sub-grade, sub-base, base course materials in accordance with ASTM Standard D1883.

1.3 Referenced Standard Construction Specifications

1.3.1. CW 3110 – Sub-Grade, Sub-Base and Base Course Construction.
1.3.2. CW 3120 – Installation of Subdrains
1.3.3. CW 3135 – Supply and Installation of Geogrid.
1.3.4. Approved Products for Surface Works.

2. MATERIALS

2.1 Approved Products

2.1.1. Use only those materials listed as Approved Products for Surface Works. The Approved Products are available in Adobe Acrobat (.pdf) format at the City of Winnipeg, Corporate Finance, Material Management Internet site at: https://www.winnipeg.ca/finance/findata/matmgt/std_const_spec/current/Docs/Approved_Products_Surface_Works.pdf

2.2 Material Identification

2.2.1. Geotextile fabric is to be labelled in accordance with ASTM D4873/D4873M, and must clearly show the manufacturer name and supplier, product style number and roll number and and date of manufacture.

2.2.2. Products without proper identification or labelling, mislabelling, or misrepresentation of materials shall be rejected.

2.3 Shipment, Storage and Handling

2.3.1. Geotextile rolls shall be wrapped with a material that will protect the geosynthetic, including the ends of the roll, from damage due to shipment, water, sunlight, and contaminants.

2.3.2. Protective wrapping shall be maintained during shipment and storage and shall remain on the geotextile fabric until installation.

2.3.3. During storage, geotextile rolls shall be elevated off the ground and adequately covered to protect them from site construction damage, precipitation, contamination of dirt or dust, extended ultraviolet radiation, and any other environmental condition that may damage the physical property values of the geosynthetic.

2.4 Certification

2.4.1. The Contractor shall provide Manufacturer's Mill Certificate and MARV Roll Data to the Contract Administrator prior to installation. The Certification shall state that the furnished geotextile meets MARV requirements of the specification as evaluated under the Manufacturer's quality control program. The Certification shall be attested to by a person having legal authority to bind the Manufacturer.

2.4.2. The Contractor shall provide a letter to the Contract Administrator stating the product name, manufacturer, style number, chemical composition of the filaments or yarns and other pertinent information to fully describe the geotextile.

2.4.3. All testing and data to be in accordance with approved ASTM standards. Data reported in accordance with other standards will not be accepted.

2.5 Geotextile Property Requirements for Separation, Filtration, and Stabilization

2.5.1. Separation Geotextile Fabric

2.5.1.1. Separation geotextile fabric will be a slit-tape or slit-film woven fabric and will be used for unsaturated subgrade soils containing low fines (less than 15% passing the 0.075 mm sieve) with CBR ≥ 3.0% and not subject to seasonal increases in moisture content or fluctuating water table.

2.5.1.2. Separation geotextile fabric shall meet or exceed the following requirements:

Table CW 3130.1 – Separation Fabric Requirements

Physical Property	Statistical Reporting	Standard	Test Method
Grab Tensile Strength, minimum	MARV	1400 N	ASTM D4632
Elongation, maximum	MARV	50%	ASTM D4632
CBR Puncture, minimum	MARV	4000 N	ASTM D 6241
Trapezoid Tear, minimum	MARV	500 N	ASTM D4533
Apparent Opening Size, maximum	TV	0.43 mm	ASTM D4751
Permittivity, minimum	MV	0.05 sec^{-1}	ASTM D4491
Flow Rate, minimum	MV	160 $l/min/m^2$	ASTM D4491
U.V. Resistance, minimum	MV	70% after 500 hrs	ASTM D4355

2.5.1.3. All physical property requirements shall be provided using the appropriate statistical reporting method in Table CW 3130.1 and as defined by ASTM D4759.

2.5.2. Separation/Filtration Geotextile Fabric

2.5.2.1. Separation/Filtration geotextile fabric will be nonwoven and will be used for subgrade soils containing high fines (more than 15% passing the 0.075 mm sieve) with CBR ≥ 3.0% and subject to seasonal increases in moisture content or fluctuating water table.

2.5.2.2. Separation/Filtration geotextile fabric shall meet or exceed the following requirements:

Table CW 3130.2 – Separation/Filtration Fabric Requirements

Physical Property	Statistical Reporting	Standard	Test Method
Grab Tensile Strength, minimum	MARV	900 N	ASTM D4632
Elongation, minimum	MARV	50%	ASTM D4632
CBR Puncture, minimum	MARV	2200 N	ASTM D 6241
Trapezoid Tear, minimum	MARV	350 N	ASTM D4533
Apparent Opening Size, maximum	TV	0.18 mm	ASTM D4751
Permittivity, minimum	MV	1.4 sec^{-1}	ASTM D4491
Flow Rate, minimum	MV	3870 $l/min/m^2$	ASTM D4491
U.V. Resistance, minimum	MV	70% after 500 hrs	ASTM D4355

2.5.2.3. All physical property requirements shall be provided using the appropriate statistical reporting method in Table CW 3130.2 and as defined by ASTM D4759.

2.5.3. Stabilization Geotextile Fabric

2.5.3.1. Stabilization fabric will be either a multi-filament fibrillated yarn high strength woven geotextile or separation/filtration geotextile fabric (non-woven) and geogrid, and will be used for saturated fine-grained subgrade (more than 15% passing the 0.075 mm sieve) with CBR less than 3.0% and/or subject to thaw weakening, or erodible silt subgrades to provide the coincident functions of separation, filtration, confinement, and reinforcement.

2.5.3.2. The multi-filament fibrillated yarn high strength woven geotextile shall meet or exceed the following requirements:

Table CW 3130.3 – Subgrade Stabilization Geotextile Fabric Requirements

Physical Property	Statistical Reporting	Machine Direction	Cross-Machine Direction	Test Method
Ultimate Tensile Strength, minimum	MARV	70.0 kN/m	70.0 kN/m	ASTM D4595
Tensile Strength (at 5% Strain), minimum	MARV	35.0 kN/m	43.8 kN/m	ASTM D4595
Flow Rate, minimum	MV	1222 $l/min/m^2$		ASTM D4491
Apparent Opening Size, maximum	TV	0.60 mm – maximum		ASTM D4751
Permittivity, minimum	MV	0.5 sec^{-1}		ASTM D4491
U.V. Resistance, minimum	MV	>70% after 500 hrs		ASTM D4355

2.5.3.3. All physical property requirements shall be provided using the appropriate statistical reporting method in Table CW 3130.3 and as defined by ASTM D4759.

2.5.3.4. Separation/filtration geotextile fabric (non-woven) and geogrid must meet the requirements of both CW 3130 Section 2.5.2 and CW 3135 Section 2.5.

3. CONSTRUCTION METHODS

3.1. Geotextiles shall not be placed when weather conditions, in the opinion of the Contract Administrator, are not suitable for installation including heavy rainfall, extreme cold or frost conditions, or extreme heat.

3.2. Commence installation of geotextile fabric after material has been approved by the Contract Administrator and the preparation of the sub-grade has been completed and accepted in accordance with CW 3110.

3.3. The surface of the subgrade should be smooth and level. Depressions or humps greater than 50 mm should be removed.

3.4. The geotextile fabric shall be laid smooth without wrinkles or folds on the prepared sub-grade in the direction of the construction traffic. The geotextile fabric shall not be rolled out more than 20 m ahead of the placement of the fill material and shall be overlapped both side to side and end to end in the direction of the construction traffic. The geotextile fabric shall be free from any tension or stress.

3.5. Adjacent geotextile rolls should be overlapped along their sides and ends as a function of subgrade strength as follows:

CBR > 3%:	450 mm overlap
3% ≥ CBR > 1.5%:	750 mm overlap
1.5% ≥ CBR > 0.5%:	900 mm overlap or sewn
CBR ≤ 0.5%:	Sewn
All roll ends	1000 mm or sewn

For every 500 metres, the average CBR value shall be used to determine the overlap.

3.6. On curves, the geotextile may be cut or folded to conform to the curves.

3.7. Place piles of sub-base material as required to hold the geotextile fabric in place. Staples or steel pins with washers, or other means approved by the Contract Administrator may be used as necessary to temporarily anchor the geotextile.

3.8. Install geotextile fabric to the complete limits of the roadway sub-grade including intersections and turning lanes or as directed by the Contract Administrator.

3.9. Prior to covering, the geotextile shall be inspected by the Contract Administrator for damage (e.g. holes, tears, rips) during installation.

3.10. Cover the damaged area with a geotextile patch that extends an amount equal to the required overlap beyond the damaged area.

3.11. Remove and replace geotextile fabric that is improperly installed or damaged as directed by the Contract Administrator.

3.12. Construction vehicles are not permitted directly on the geotextile. Turning of vehicles shall not be permitted on the first lift above the geotextile.

3.13. Geotextile shall not remain uncovered for longer than 7 days after installation.

3.14. Install geotextile fabric in accordance with this specification and procedures recommended by the manufacturer.

3.15. Place and compact the sub-base over the geotextile fabric in accordance with CW3110.

4. MEASUREMENT AND PAYMENT

4.1. Supply and installation of "Geotextile Fabric" will be measured on an area basis and paid for at the Contract Unit Price per square metre for "Geotextile Fabric". The area to be paid for will be the total number of square metres of "Geotextile Fabric" (*), supplied and installed in accordance with this specification, accepted and measured by the Contract Administrator.

(*) - Specify Separation, Separation/Filtration, or Stabilization.

4.2. Only material placed within the designated sub-grade limits will be included in the payment for "Geotextile Fabric".

4.3. No measurement or payment will be made for geotextile fabric removed and replaced due to improper installation or damaged materials.

4.4. No measurement or payment will be made for overlapped material described in this Specification.

PUBLIC WORKS DEPARTMENT • SERVICE DES TRAVAUX PUBLICS Engineering Division • Division de l'ingénierie	**Effective Date:** January 28, 2020 **DIVISION 4**
CW 3135 – R2	**SUPPLY AND INSTALLATION OF GEOGRID**

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1. DESCRIPTION

1.1 General

1.1.1 This specification covers the supply and installation of geogrid for use as reinforcement of base or subbase layers for pavement structures.

1.1.2 This specification also covers the supply and installation of geogrid in conjunction with a separation/filtration (nonwoven) geotextile fabric for use in subgrade stabilization applications.

1.2 Definitions

Geogrids:	A synthetic planar structure formed by a regular network of tensile strength elements with apertures of sufficiently large size to allow for interlocking with the surrounding soil to perform the primary function of reinforcement.
Minimum Average Roll Value (MARV):	Property value calculated as typical minus two standard deviations. It shall yield a 97.7 percent degree of confidence that any sample taken during quality assurance testing will exceed value reported.
Apertures:	The open spaces formed between the interconnected network of longitudinal and transverse ribs of a geogrid.
Separation:	A geosynthetic function in which a geotextile is used to prevent mixing of two dissimilar materials to maintain their engineering properties such as a subgrade soil and an aggregate cover.
Filtration:	A geosynthetic function in which a geotextile is placed between two dissimilar soils to allow for long-term passage of water into a subsurface drainage system and retain the in-situ soil.
Reinforcement:	A geosynthetic function in which a geotextile acts as a tensile member in the surface structure of a pavement.
Confinement:	A geosynthetic function in which a geosynthetic prevents the lateral movement (rutting) of aggregate.
Stabilization:	The use of a geosynthetic or combination of geosynthetics and geogrid on weak to very weak subgrade conditions (CBR ≤ 3.0%) to provide the coincident functions of separation, filtration, reinforcement, and confinement.
California bearing ratio (CBR)	Standard test method for evaluation the potential strength of sub-grade, sub-base, base course materials in accordance with ASTM Standard D1883.

Class A — Geogrid that can be used for severe survivability conditions. Generally appropriate beneath or within base course and 50 mm and 100 mm sub-base materials to provide lateral confinement to aggregate materials, subgrade restraint, and an improved effective bearing capacity for trafficked structures constructed over good to poor sub-grades.

Class B — Geogrid that can be used for moderate survivability conditions. Generally appropriate for beneath or within base course and 50 mm sub-base materials to provide lateral confinement to aggregate materials, subgrade restraint, and an improved effective bearing capacity for trafficked structures constructed over sub-grades with CBR ≥ 1.5.

1.3 Referenced Standard Construction Specifications

1.3.1. CW 3110 – Sub-Grade, Sub-Base and Base Course Construction.
1.3.2. CW 3130 – Supply and Installation of Geotextile Fabrics
1.3.3. Approved Products for Surface Works.

2. MATERIALS

2.1 Approved Products

2.1.1 Use only those materials listed as Approved Products for Surface Works. The Approved Products are available in Adobe Acrobat (.pdf) format at the City of Winnipeg, Corporate Finance, Material Management Internet site at: https://www.winnipeg.ca/finance/findata/matmgt/std_const_spec/current/Docs/Approved_Products_Surface_Works.pdf

2.2 Material Identification

2.2.1. Geogrid is to be labelled in accordance with ASTM D4873/D4873M, and must clearly show the manufacturer name, product style number and roll number.

2.2.2. Products without proper identification or labelling, mislabelling, or misrepresentation of materials shall be rejected.

2.3 Storage and Handling

2.3.1 Geogrid rolls shall be elevated off the ground and adequately covered to protect them from site construction damage, precipitation, any contamination of dirt, dust any other deleterious materials.

2.3.2 Geogrid rolls shall be protected from extended ultraviolet radiation including sunlight, chemicals that are strong acids or strong bases, flames including welding sparks, excess temperatures, and any other environmental conditions that may damage the physical properties of the geotextile.

2.3.3 Store and handle the geogrid in accordance with the manufacturer's recommendations.

2.4 Certification

2.4.1 The Contractor shall provide Manufacturer's Mill Certificate and MARV Roll Data to the Contract Administrator prior to installation. The Certification shall state that the geogrid meets MARV requirements of the specification as evaluated under the Manufacturer's quality control program. The Certification shall be attested to by a person having legal authority to bind the Manufacturer.

2.4.2 The Contractor shall provide a letter to the Contract Administrator stating the product name, manufacturer, style number, and other pertinent information to fully describe the geogrid.

2.4.3 All testing and data to be in accordance with approved ASTM standards. Data reported in accordance with other standards will not be accepted.

2.5 Geogrid Properties for Reinforcement of Base Course or Sub-base Layers

2.5.1. Geogrid will be extruded polypropylene, bi-axial, single layer with opening configuration either square or rectangular in shape.

2.5.2. The axis with the least strength will be taken as the ultimate strength of the geogrid for any given property.

2.5.3. Class A geogrids shall meet the requirements in Table CW 3135.1.

Table CW 3135.1 – Class A Geogrid Property Requirements

Physical Property	Machine Direction	Cross-Machine Direction	Test Method
Ultimate Tensile Strength	30 kN/m	30 kN/m	ASTM D 6637
Tensile Strength @ 2% Strain	10.5 kN/m	10.5 kN/m	ASTM D 6637
Tensile Strength @ 5% Strain	21.0 kN/m	21.0 kN/m	ASTM D 6637
Junction Strength	24.0 kN/m		ASTM D 7737
Junction Efficiency	90%		ASTM D 7737
Aperture Stability at applied moment of 20kg-cm	7.5 m-N/degree		ASTM D 7864
Aperture Sizes	12.5 – 60 mm		Direct Measure
Flexural Rigidity	1,500,000		ASTM D 7748
U.V. Resistance	70% after 500 hrs		ASTM D4355

2.5.4. Class B geogrids shall meet the requirements in Table CW 3135.2.

Table CW 3135.2 – Class B Geogrid Property Requirements

Physical Property	Machine Direction	Cross-Machine Direction	Test Method
Ultimate Tensile Strength	19.0 kN/m	24.0 kN/m	ASTM D 6637
Tensile Strength @ 2% Strain	6.0 kN/m	9.0 kN/m	ASTM D 6637
Tensile Strength @ 5% Strain	11.8 kN/m	19.6 kN/m	ASTM D 6637
Junction Strength	17.0 kN/m		ASTM D 7737
Junction Efficiency	90%		ASTM D 7737
Aperture Stability at applied moment of 20kg-cm	6.5 m-N/degree		ASTM D 7864
Aperture Sizes	12.5 – 38 mm		Direct Measure
Flexural Rigidity	750,000		ASTM D 7748
U.V. Resistance	70% after 500 hrs		ASTM D4355

2.5.5. All physical property requirements are Minimum Average Roll Values (MARV) determined in accordance with ASTM 4759. Values not labelled as MARV will not be accepted.

2.5.6. Aperture Sizes shall be as follows:

2.5.6.1. Between 12.5 mm and 25 mm for geogrids immediately below or within the base course layer.

2.5.6.2. Between 25 mm and 38 mm for geogrids immediately below or within 50 mm sub-base layers.

2.5.6.3. Between 38 mm and 60 mm for geogrids immediately below or within 100 mm sub-base layers.

2.5.7. If the geogrid has a rectangular aperture size, the smaller dimension shall be used to choose the suitable geogrid.

2.6 Separation/Filtration Geotextile Fabric (non-woven) and Geogrid for Separation, Filtration, and Reinforcement

2.6.1. Separation/filtration geotextile fabric (non-woven) and geogrid must meet the requirements of both CW 3130 Section 2.5.2 and CW 3135.

2.6.2. Geotextile/Geogrid composite products must meet the requirements of both CW 3135 and CW 3130.

3. CONSTRUCTION METHODS

3.1. Geogrid shall not be placed when weather conditions, in the opinion of the Contract Administrator, are not suitable for installation including heavy rainfall, extreme cold or frost conditions, or extreme heat.

3.2. The geogrid shall be laid smooth without wrinkles or folds on the Separation/Filtration geotextile fabric or prepared sub-grade in the direction of construction traffic. The geogrid shall be free from any tension or stress.

3.3. Adjacent geogrid rolls should be overlapped along their sides and ends as a function of subgrade strength as follows:

CBR > 3%:	450 mm overlap
3% ≥ CBR > 1.5%:	750 mm overlap
1.5% ≥ CBR > 0.5%:	900 mm overlap or sewn
CBR ≤ 0.5%:	A multi-filament fibrillated yarn high strength woven geotextile in accordance with CW 3130 shall be used

3.4. Cut geogrid to conform to curves.

3.5. Place piles of base or sub-base material as required to hold geogrid in place. Pins and washers are not permitted.

3.6. Install geogrid to the limits of the roadway sub-grade including intersections and turning lanes or as directed by the Contract Administrator.

3.7. Prior to covering, the geogrid shall be inspected by the Contract Administrator for damage during installation.

3.8. Cover the damaged area with a geogrid patch that extends an amount equal to the required overlap beyond the damaged area.

3.9. Remove and replace geogrid that is improperly installed or damaged as directed by the Contract Administrator.

3.10. Construction vehicles are not permitted directly on the geogrid. Turning of vehicles shall not be permitted on the first lift above the geogrid.

3.11. Avoid sudden stops or sharp turns by construction equipment during placement of sub-base materials.

3.12. Geogrid shall not remain uncovered for longer than 7 days after installation.

3.13. Install geogrid in accordance with this specification and the manufacturer's recommendations.

3.14. Place and compact base course and sub-base materials over the geogrid in accordance with CW3110.

4. MEASUREMENT AND PAYMENT

4.1. Supply and installation of "Geogrid or Geotextile/Geogrid Composite" will be measured on an area basis and paid for at the Contract Unit Price per square metre for "Supply and Install Geogrid or Geotextile/Geogrid Composite". The area to be paid for will be the total number of square metres of "Geogrid or Geotextile/Geogrid Composite", supplied and installed in accordance with this specification, accepted and measured by the Contract Administrator.

Items of Work:

i.) Class A Geogrid
ii.) Class B Geogrid
iii.) Geotextile/Class A Geogrid Composite
iv.) Geotextile/Class B Geogrid Composite

4.2. Only material placed within the designated sub-grade limits will be included in the payment for "Supply and Install Geogrid".

4.3. No measurement or payment will be made for geogrid removed and replaced due to improper installation or damaged materials.

4.4. No measurement or payment will be made for the overlap described in this Specification.

CW 3170 – EARTHWORK AND GRADING

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CW 3170 - EARTHWORK AND GRADING

1. GENERAL CONDITIONS

The General Conditions and Standard Provisions attached hereto shall apply to and be a part of this Specification.

3. DESCRIPTION

This Specification shall cover all phases of removal and/or placement of all materials necessary for the construction and preparation of embankments, slopes, drainage works, and approaches.

The work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies and all other things necessary for and incidental to the satisfactory performance and completion of all work as hereinafter specified.

5. MATERIALS

5.1 General

The Contractor shall be responsible for the supply, safe storage and handling of all materials set forth in this Specification.

5.2 Handling and Storage of Materials

All materials shall be handled and stored in a careful and workmanlike manner, to the satisfaction of the Contract Administrator.

5.3 Testing and Approval

All materials supplied under this Specification shall be subject to inspection and testing by the Contract Administrator or by the Testing Laboratory designated by the Contract Administrator. There shall be no charge to the City for any materials taken by the Contract Administrator for testing purposes.

The Contract Administrator shall approve all materials at least ten (10) days before any construction is undertaken. If, in the opinion of the Contract Administrator, such materials, in whole or in part, do not conform to the Specification detailed herein or are found to be defective in manufacture or have become damaged in transit, storage or handling operations, then such material shall be rejected by the Contract Administrator and replaced by the Contractor at his own expense.

5.4 Fill Material

Fill material for embankment construction shall be obtained from site excavation, from borrow sites as specified in the Specifications for the Work or shall be imported material, of a type approved by the Contract Administrator.

Approved clay fill material shall consist of low to medium plastic clays or of mixtures of sand and clay, uniform in texture and suitable for compaction.

5.5 Sub-base Material

Sub-base material shall conform to Section 5.4 of Specification CW 3110.

8. EQUIPMENT

All equipment shall be of a size and type as required to complete the work in reasonable time as approved by the Contract Administrator, and shall be kept in good working order.

9. CONSTRUCTION METHODS

9.1 Clearing and Grubbing

No earthwork and grading shall commence until clearing and grubbing operations have been completed in accordance with Specification CW 3010 and the Drawings, and have been approved by the Contract Administrator.

9.2 Excavation

Excavation shall consist of topsoil excavation, common excavation and borrow excavation, which shall be understood to mean the following:

a) Topsoil Excavation

The excavation of surface soil, organic growth, or other material designated by the Contract Administrator as overburden, the stockpiling of topsoil for re-use on site, and the satisfactory disposal of unsuitable material such as brush, grass, weeds and all other organic growth and any surface topsoil, unless otherwise specified herein or in the Specifications for the Work.

b) Common Excavation

The excavation of all material encountered within the limits of grading following topsoil excavation, the on-site placement or the stockpiling of suitable site material, and the satisfactory disposal of unsuitable site material such as frost heaving clays, silts, rock, rubble, rubbish and any surplus suitable site material, unless otherwise specified herein or in the Specifications for the Work.

c) Borrow Excavation

The excavation and placing of excavated material, obtained from designated borrow locations. The widening of roadway cuts and ditches will not be considered as borrow.

The excavation procedure shall be subject to the approval of the Contract Administrator. Excavation shall continue in as nearly a continuous manner as possible. Excavation at multiple locations at the same time shall be subject to the approval of the Contract Administrator.

The Contractor shall conduct his excavation procedure in such a manner as to enable the Contract Administrator to inspect the separation of materials and determine which materials are to be disposed of and which materials are to be used.

The Contractor shall excavate as required to reach sub-grade levels of pavement and landscaping, and rough grade levels for areas to be graded only.

During the course of common excavation, the Contractor will be advised by the Contract

Administrator as to which areas have an unsuitable sub-grade. In the areas of unsuitable sub-grade, whether in a homogeneous mass or in isolated pockets, the excavation shall be extended either to the lower limit of the unsuitable material or to a depth of one metre below the elevation of the bottom of base course for a Portland cement concrete pavement, or to a depth of 600 mm below the elevation of the bottom of sub-base for an asphaltic concrete pavement, whichever is lesser, unless otherwise specified on the Drawings or in the Specifications for the Work. Additional excavation of unsuitable material may be required as specified by the Contract Administrator.

In areas of excavation of unsuitable material, the side of the excavation may be sloped into the excavation provided that the sides remain at least 150 mm outside of the limits of the proposed pavement at the bottom of the excavation. The longitudinal slope shall not be steeper than 1:1.

Excavation of solid bedrock, glacial till, boulders, loose rock, concrete rubble and foundations which are located within the limits of excavation and which require the use of additional or unconventional excavation equipment shall be measured and paid for in addition to the unit prices for excavation.

9.3 Removal of Existing Pavement

Removal of existing pavement shall conform to the requirements of Specification CW 3110.

9.4 Disposal of Material

Disposal of material shall be understood to mean the removal of a material from the site, hauling of the material along a route approved by the Contract Administrator, and the unloading and grading of the material in a manner satisfactory to the Contract Administrator at a legal disposal site.

If a disposal site is not otherwise indicated in the Specifications for the Work, the Contractor shall locate a legal disposal site and identify a haul route to be approved by the Contract Administrator.

Any material dropped or spilled on any streets during the hauling operation shall be promptly cleaned up by and at the expense of the Contractor, to the satisfaction of the Contract Administrator.

9.5 Preparation of Existing Ground Surface

Before any embankment is placed on original ground having a smooth firm surface, the existing ground shall be scarified or ploughed so as to permit bonding with the new material.

Where the existing ground surface is sloped sufficiently to affect the bond between the old and new materials the original ground on which the embankment is to be placed shall be ploughed deeply or stepped before embankment construction is commenced, as directed by the Contract Administrator.

When embankment is being placed on an existing roadbed, the side slopes of the existing roadbed shall have vegetation removed and then be scarified or ploughed, as directed by the Contract Administrator, to ensure adequate bonding between the new embankment and the existing material.

Following the excavation and disposal of unsuitable material and the preparation of the side slopes, as described above, the surface of the existing roadbed shall be scarified to a depth of 150 mm, and compacted to the proper density, at the optimum moisture content.

Where existing roadbeds are being widened and existing embankments extended, the existing slopes shall be denuded of all vegetation and either stepped or ploughed so as to form a medium of contact with the new embankment. Vertical cuts for the full depths of embankment shall not be permitted.

9.6 Embankment

Embankment construction shall be understood to mean the placing of suitable earth fill to obtain the required lines, grades and cross-sections shown on the drawings.

Materials shall be deposited and spread in uniform layers of specified thickness, for the full width of the embankment. Each layer shall be shaped to line and cross-section and thoroughly compacted before the succeeding layer is placed.

Where embankment is being placed on side fill or sloping sections, the lower portion shall be constructed as above, until a full width surface of the specified cross-section is obtained. The embankment shall be completed thereafter with full width layers.

Flood protection embankment fill materials shall be clay fill material as specified in Clause 5.4.

9.7 Compaction

All material placed in embankments shall be spread and bladed smooth in successive layers not exceeding 150 mm in compacted thickness to the full width of the cross-section, unless otherwise directed by the Contract Administrator.

Each layer, including the existing sub-grade, shall be compacted to a minimum of ninety-five (95%) percent of Standard Proctor Density. The material shall be compacted at the optimum moisture content, or up to two (2%) percent higher than optimum, as directed by the Contract Administrator.

Where the grade line is in cut, the sub-grade shall be excavated to a minimum depth of 500 mm below the sub-grade line, or as directed by the Contract Administrator. The sub-grade shall then be reconstructed in layers as specified and compacted to ninety-five (95%) percent of Standard Proctor Density.

Where the moisture content of the embankment material is too high, the material shall be thoroughly worked until the optimum moisture content is achieved.

Where the moisture content of the embankment material is too low, the material shall be thoroughly disced and broken down, water added as required and the material thoroughly worked to mix the water throughout the material, prior to commencing compaction operations.

9.8 Finishing and Maintaining

The Contractor shall, as soon as practicable, bring the excavations and embankments to the correct widths, lines and grades as shown on the Drawings.

All surfaces shall be maintained to the specified grade and cross-section and to the specified density until the project or that portion of the project is accepted.

9.9 Boulevard Grading

Boulevard grading shall be done and paid for in accordance with Specification CW 3110.

10. QUALITY CONTROL

10.1 Inspection

All workmanship and all materials furnished and supplied under this Specification are subject to close

and systematic inspection and testing by the Contract Administrator including all operations from the selection and production of materials through to 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 Contract Administrator reserves the right to reject any materials or works that are not in accordance with the requirements of this Specification.

10.2 Access

The Contract Administrator shall be afforded full access for the inspection and control testing of materials, both at the site of work and at any plant or borrow pit used for the supply of the materials, to determine whether the material is being supplied in accordance with this Specification.

10.3 Materials

All materials supplied under this Specification shall be subject to testing and approval by the Contract Administrator in accordance with Section 5.3 of this Specification.

10.4 Quality of Sub-grade and Embankment Materials

The Standard Proctor Density for the sub-grade and embankment materials shall be determined at the optimum moisture content in accordance with ASTM Standard D698. The field density of each layer shall be a percentage of the Standard Proctor Density, as specified in Section 9.7 of this Specification.

Quality control tests will be used to determine the acceptability of each layer, as placed and compacted by the Contractor, before the succeeding layer may be applied.

The field density of the compacted layers shall be verified by Field Density Tests in accordance with ASTM Standard D1556, Test for Density of Soil in Place by the Sand-Cone Method, or ASTM Standard D2922, Test of Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

The frequency and number of tests to be made shall be as determined by the Contract Administrator.

Holes made by the removal of samples from the layers shall be promptly filled by the Contractor with appropriate material and thoroughly compacted so as to conform in every way with the adjoining compacted material.

10.5 Corrective Action

The Contractor shall, at his own expense, correct such work or replace such materials found to be defective under this Specification in an approved manner to the satisfaction of the Contract Administrator.

12. METHOD OF MEASUREMENT

12.1 Excavation

Excavation will be measured on a volume basis. The volume to be paid for shall be the total number of cubic metres that are excavated in accordance with this Specification acceptable to the Contract Administrator, as computed from measurements made by the Contract Administrator. No payment will be made for material removed outside of the limits of excavation.

The volume of the various types of excavation shall be as measured in its original position, and as determined by the method of Average End Areas.

12.2 Fill Material

a) Suitable Site Material

Suitable site material will be measured on a volume basis. The volume to be paid for shall be the total number of cubic metres compacted in place in accordance with this Specification acceptable to the Contract Administrator, as computed from cross-sections taken by the Contract Administrator using the method of Average End Areas. No payment will be made for material placed outside of the limits of placement as directed by the Contract Administrator.

b) Clay Borrow Material

Clay borrow material will be measured on a volume basis. The volume to be paid for shall be the total number of cubic metres compacted in place in accordance with this Specification acceptable to the Contract Administrator, as computed from cross-sections taken by the Contract Administrator using the method of Average End Areas. No payment will be made for material placed outside of the limits of placement as directed by the Contract Administrator.

c) Imported Material

Imported material will be measured on a volume basis. The volume to be paid for shall be the total number of cubic metres compacted in place in accordance with this Specification acceptable to the Contract Administrator, as computed from cross-sections taken by the Contract Administrator using the method of Average End Areas. No payment will be made for material placed outside of the limits of placement as directed by the Contract Administrator.

12.3 Preparation of Existing Ground Surface

Preparation of the existing ground surface will be measured on an area basis. The area to be paid for shall be the total number of square metres that are prepared in accordance with this Specification acceptable to the Contract Administrator, as computed from measurements made by the Contract Administrator.

13. BASIS OF PAYMENT

13.1 Topsoil Excavation

Topsoil excavation will be paid for at the Contract Unit Price per cubic metre for "Topsoil Excavation", measured as specified herein, which price shall be payment in full for performing all operations herein described and all other items incidental to the work included in this Specification.

13.2 Common Excavation

Common excavation will be paid for at the Contract Unit Price per cubic metre for the "Items of Work" listed here below, measured as specified herein, which price shall be payment in full for performing all operations herein described and all other items incidental to the work included in this Specification.

Items of Work:

i. Common Excavation – Suitable Site Material
ii. Common Excavation – Unsuitable Site Material

13.3 Fill Material

a) Suitable Site Material

The loading, hauling, placing and compaction of suitable site sub-base material will be paid for at the Contract Unit Price per cubic metre for “Placing Suitable Site Material”, measured as specified herein, which price shall be payment in full for performing all operations herein described and all other items incidental to the work included in this Specification.

b) Clay Borrow Material

The supplying, placing and compaction of clay borrow sub-base material will be paid for at the Contract Unit Price per cubic metre for “Supplying and Placing Clay Borrow Material”, measured as specified herein, which price shall be payment in full for performing all operations herein described and all other items incidental to the work included in this Specification.

c) Imported Material

The supplying, placing and compaction of imported material will be paid for at the Contract Unit Price per cubic metre for “Supplying and Placing Imported Material”, measured as specified herein, which price shall be payment in full for performing all operations herein described and all other items incidental to the work included in this Specification.

13.4 Preparation of Existing Ground Surface

Preparation of the existing ground surface will be paid for at the Contract Unit Price per square metre for "Preparation of Existing Ground Surface", measured as specified herein, which price shall be payment in full for performing all operations herein described and all other items incidental to the work included in this Specification.

CW 3210 – ADJUSTMENT OF PAVEMENT AND BOULEVARD STRUCTURES

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CW 3210 – ADJUSTMENT OF PAVEMENT AND BOULEVARD STRUCTURES

1. DESCRIPTION

1.1 General

.1 This specification covers the adjustment of pavement and boulevard structures including existing manholes and catch basin frames, curb and gutter inlet frames, curb inlets with new inlet box, water valves and curb stops.

1.3 Referenced Standard Construction Specifications

.1 CW 1120 – Existing Services, Utilities and Structures
.2 CW 1130 – Site Requirements
.3 CW 2030 – Excavation Bedding and Backfill
.4 CW 2130 – Gravity Sewers
.5 CW 2160 – Concrete Underground Structures and Works
.6 CW 3110 – Sub-Grade, Sub-Base and Base Course Construction
.7 CW 3230 – Full-Depth Patching of Existing Slabs and Joints
.8 CW 3235 – Renewal of Existing Miscellaneous Concrete Slabs
.9 CW 3310 – Portland Cement Concrete Pavement Works

1.4 Referenced Standard Details

.1 SD – 002 Standard Trench and Excavation Backfill Classes
.2 SD – 010 Standard Precast Concrete Manhole (For up to 525 Diameter Pipe)
.3 SD – 011 Standard Precast Concrete Manhole (For 600 to 1500 Diameter Pipe)
.4 SD – 016 Standard Watermain Valve Installation
.5 SD – 023 Catchpit
.6 SD – 024 Catch Basin
.7 SD – 221 Curb Inlet with Catch Basin in Pavement
.8 SD – 222 Curb Inlet with Catch Basin in Boulevard

1.5 Referenced Approved Product Drawings

.1 AP-002 – Watermain Valve Box Extension
.2 AP-006 – Standard Frame for Manhole and Catch Basin (Manhole Frame)
.2 AP-007 – Standard Solid Cover for Standard Frame (Solid Manhole Cover)
.3 AP-008 – Standard Grated Cover for Standard Frame (Grated Manhole Cover)
.5 AP-009 – Beehive Manhole Cover
.4 AP-010 – Lifter Ring (Manhole Riser Ring)
.5 AP-011 – Barrier Curb and Gutter Frame (Barrier Curb Frame)
.6 AP-012 – Barrier Curb and Gutter Cover (Barrier Curb Cover)
.7 AP-015 – Mountable Curb and Gutter Frame (Mountable Curb Frame)
.8 AP-016 – Mountable Curb and Gutter Cover (Mountable Curb Cover)
.9 AP-017 – Mountable Curb and Gutter Paving Cover (Mountable Curb Paving Cover)
.10 AP-018 – Modified Barrier Curb and Gutter Frame (Modified Barrier Curb Frame)
.11 AP-019 – Modified Barrier Curb and Gutter Cover (Mountable Barrier Curb Cover)
.12 AP-020 – Curb Inlet Box Cover
.13 AP-021 - Integrated Side Inlet and Cover

2. MATERIALS

2.1 Approved Products

.1 "AP's" are references to detail drawings in the Approved Products for Underground Use in the City of Winnipeg, found on the City of Winnipeg, Materials Management web site at: http://www.winnipeg.ca/matmgt/spec/default.stm

2.2 Frames and Covers

.1 Frames and covers in accordance with AP-006, AP-007, AP-008, AP-009, AP-011, AP-012, AP-015, AP-016, AP-017, AP-019, AP, AP-020 and AP-021 .

2.3 Drainage Connection Pipe

.1 Drainage connection pipe, fittings, gaskets and other accessories in accordance with CW 2130.

2.4 Lifter Ring

.1 Lifter ring in accordance with AP-010.

2.5 Valve Box Extensions

.1 Valve box extensions in accordance with AP-002.

2.6 Curb Stop Extensions

.1 Curb stop extensions "Milk Bottle" type, grey iron Class 20 in accordance with ASTM A48. TF-200 as manufactured by Titan Foundry.

2.7 Concrete Brick

.1 Concrete brick in accordance with CAN 3 – A165 series.

2.8 Joint Material

.1 Joint material shall be preformed bituminous gaskets or flexible Butyl rubber joint sealant as approved by the Contract Administrator.

2.9 Curb Inlet Frames

.1 Acceptable Curb inlet frames are TF-110 and TF-111 as manufactured by Titan Foundry.

2.10 Curb Inlet Box Covers

.1 Curb inlet box covers in accordance with AP-020.

2.11 Grout

.1 Grout shall be one part Type 50 Portland cement and one part sand in accordance with CW 2160.

3. CONSTRUCTION METHODS

3.1 General

.1 Dispose of damaged materials in accordance with Section 3.4 of CW 1130.

.2 Inspect existing manholes, catch basin, catchpits and inlet boxes prior to commencing work in accordance with Section 3.8 of CW 1120 to record amount of existing debris.

.3 Load and deliver all surplus materials to Water and Waste Department, Water Services Division yard located at 552 Plinquet Street as directed by the Contract Administrator. Unload salvaged material as directed by City personnel.

.4 Remove construction debris and materials from manholes, catch basins, catchpits and inlet boxes when work is complete.

.5 Supply and install precast concrete riser sections and flat top reducers in accordance with Section 3.13 of CW 2130 as directed by the Contract Administrator.

.6 Remove and construct pavement required to complete adjustments in accordance with CW 3110, CW 3230, CW 3235 and CW 3310.

.7 No measurement or payment will be made for replacing pavement and boulevard structures/appurtenances damaged or lost during adjustment.

3.2 Adjustment of Manholes/Catch Basins Frames

.1 Adjust existing manhole and catch basin frames at locations shown on the Drawings or as directed by the Contract Administrator.

.2 For paved areas, remove pavement without damaging frame.

.3 Further to 3.1.7, supply new frames and/or covers to replace damaged/lost materials.

.4 Prevent construction material and debris from entering sewers.

.5 Remove existing grout and bricks without damaging precast concrete riser sections or flat top reducers.

.6 Replace, remove or add precast concrete riser sections in accordance with 3.13 of CW 2130 as directed by the Contract Administrator.

.7 Set frame to finished grade with bricks or as approved by Contract Administrator. Distance between bottom of frame and precast riser section or flat top reducer shall not exceed 75 millimetres.

.8 For adjustments of frames within concrete pavements with asphalt overlays, set frame 50 millimetres below finished grade to allow for installation of a lifter ring. Supply and install lifter ring in accordance with Section 3.7 of this specification.

.9 Grout frame inside and out to make watertight. Remove excess grout from inside of manhole or catch basin.

.10 Place and compact Class 2 backfill as required in accordance with CW 2030 and SD-002.

3.3 Adjustment of Curb and Gutter Frames

.1 Adjust existing curb and gutter frames at locations shown on the Drawings or as directed by the Contract Administrator.

.2 Remove pavement without damaging frame.

.3 Further to 3.1.7, supply new frames and/or covers to replace damaged/lost materials.

.4 Prevent construction material and debris from entering sewer.

.5 Remove existing grout and bricks without damaging flat top reducer.

.6 Replace, remove or add precast concrete riser sections in accordance with 3.13 of CW 2130 as directed by the Contract Administrator.

.7 Set frame to finished grade with brick as approved by Contract Administrator. Distance between bottom of frame and flat top reducer shall not exceed 75 millimetres.

.8 Adjust curb portion of frame to match finished curb height.

.9 Grout frame inside and out to make watertight. Remove excess grout from inside of catch basin or catchpit.

.10 Place and compact Class 2 backfill as required in accordance with CW 2030 and SD-002.

3.4 Adjust Curb Inlet with Inlet Box

.1 Adjust existing curb inlet with new inlet box as shown on the Drawings or as directed by the Contract Administrator.

.2 Remove concrete without damaging the frame.

.3 Remove the curb inlet frame and drainage pipe as required for installation of a new inlet box.

.4 Further to 3.1.7, supply new curb inlet frames, boxes and/or covers to replace damaged/lost materials.

.5 Install curb inlet frame to match finished grade of curb.

.6 Construct new inlet box in accordance with SD-221 and SD-222 and supply Type 2 concrete in accordance with CW 3310.

.7 Install drainage connection pipe as required from the new inlet box to the catch basin in accordance with Section 3.11 of CW 2130.

.8 Install new inlet box cover as required.

.9 Place and compact Class 4 backfill as required in accordance with CW 2030 and SD-002.

3.5 Adjustment of Valve Box

.1 Adjust existing valve box at locations shown on the Drawings or as directed by the Contract Administrator.

.2 For paved areas, remove pavement without damaging the valve box.

.3 Further to 3.1.7, supply new valve boxes to replace damaged/lost materials.

.4 Raise or lower upper section of valve box in accordance with SD-016 to match the finished grade of pavement, sidewalk or grassed area.

.5 When upper section of valve box cannot be adjusted, supply and install valve box extension in

accordance with 3.8 of this specification.

3.6 Adjustment of Curb Stops

.1 Adjust existing curb stops at locations shown on the Drawings or as directed by the Contract Administrator.

.2 For paved areas, remove pavement and excavate as required without damaging the curb stop.

.3 Further to 3.1.7, supply new curb stop parts to replace damaged/lost materials.

.4 Raise or lower upper section of curb stop to match finished grade of sidewalk or grassed area.

.5 When lid is damaged or upper section of curb stop cannot be adjusted, supply and install curb stop extension.

3.7 Lifter Ring

.1 Install lifter ring of variable heights at locations as shown on the Drawings or directed by the Contract Administrator.

.2 Remove existing cover, clean existing frame, install lifter ring and reinstall cover.

.3 Use minimum number of lifter rings to adjust manhole/catch basin to finished grade as approved by the Contractor Administrator.

3.8 Valve Box Extensions

.1 Install valve box extension at locations shown on the Drawings or as directed by the Contract Administrator.

.2 Remove existing lid, clean existing valve box and install valve box extension to finished grade.

.3 Orientate lid to close in the direction of traffic.

3.9 Mountable Curb Paving Cover

.1 Install at locations as shown on the Drawings or directed by the Contract Administrator.

.2 Remove existing cover, clean existing frame, install new paving cover to finished grade as approved by the Contract Administrator

3.10 Adjustment of Traffic Signal Service Box Frames

.1 Adjust existing or new traffic signal service box frames at locations shown on the Drawings or as directed by the Contract Administrator.

.2 For paved areas, remove miscellaneous concrete slabs without damaging frame or service box.

.3 Further to 3.1.7, supply new frames and/or covers to replace damaged/lost materials.

.4 Prevent construction material and debris from entering the existing service box.

.5 New frames and covers will be supplied by the Traffic Signals Branch as approved by the Contract Administrator.

.6 Install cardboard form tubing as required to complete the adjustment.

.7 Pour frames monolithic with placement of concrete for paved areas.

.8 For interlocking paving stone areas, entire concrete wall of service box to match finished grade.

.9 Set frame to finished grade as approved by the Contract Administrator.

.10 Place and compact Class 2 backfill as required in accordance with CW 2030 and SD-002.

4. MEASUREMENT AND PAYMENT

4.1 Adjustment of Manholes/Catch Basins Frames

.1 Adjustment of existing manholes/catch basin frames will be measured on a unit basis and paid for at the Contract Unit Price per unit for "Adjustment of Manholes/Catch Basins Frames". The number of units to be paid for will be the total number of existing catch basins and manholes frames adjusted in accordance with this specification, accepted and measured by the Contract Administrator.

.2 New precast concrete riser sections shall be paid for in accordance with CW 2130.

4.2 Adjustment of Curb and Gutter Frames

.1 Adjustment of existing curb and gutter frames will be measured on a unit basis and paid for at the Contract Unit Price per unit for "Adjustment of Curb and Gutter Frames". The number of units to be paid for will be the total number of existing curb and gutter frames adjusted in accordance with this specification, accepted and measured by the Contract Administrator.

.2 New precast concrete riser sections shall be paid for in accordance with CW 2130.

4.3 Frames and Covers

.1 Frames and Covers will be measured on a unit basis and paid for at the Contract Unit Price per unit for the "Items of Work" listed here below. The number of units to be paid for will be the total number of each unit supplied and installed in accordance with this specification, accepted and measured by the Contract Administrator.

Frames and Covers

i.) AP-006 Standard Frame for Manhole and Catch Basin
ii.) AP-007 Standard Solid Cover for Standard Frame
iii.) AP-008 Standard Grated Cover for Standard Frame
iv.) AP-009 Beehive Manhole Cover
v.) AP-011 Barrier Curb and Gutter Frame
vi.) AP-012 Barrier Curb and Gutter Cover
vii.) AP-015 Mountable Curb and Gutter Frame
viii.) AP-016 Mountable Curb and Gutter Cover
ix.) AP-017 Mountable Curb and Gutter Paving Cover
x.) AP-018 Modified Barrier Curb and Gutter Frame
xi.) AP-019 Modified Barrier Curb and Gutter Cover
xii.) AP-021 Integrated Side Inlet and Cover

4.4 Adjustment of Curb Inlet with New Inlet Box

.1 Adjustment of existing curb inlets with new inlet boxes will be measured on a unit basis and paid for at the Contract Unit Price per unit for "Adjustment of Curb Inlet with New Inlet Box". The number of units to be paid for will be the total number of existing curb inlets with new inlet boxes adjusted in accordance with this specification, accepted and measured by the Contract

Administrator.

.1 All costs for the supply and installation of the curb inlet box covers will be included in the adjustment of the curb inlet with new inlet box.

.2 Drainage connection pipe shall be paid for in accordance with CW 2130.

4.5 Curb Inlet Box Covers

.1 Curb inlet box covers will be measured on a unit basis and paid for at the Contract Unit price per unit for "Curb Inlet Box Covers". The number of units to be paid for will be the total number of curb inlet box covers supplied and installed in accordance with this specification, accepted and measured by the Contract Administrator.

4.6 Curb Inlet Frames

.1 Curb inlet frames will be measured on a unit basis and paid for at the Contract Unit price per unit for "Curb Inlet Frames". The number of units to be paid for will be the total number of curb inlet frames supplied and installed in accordance with this specification, accepted and measured by the Contract Administrator.

4.7 Adjustment of Valve Boxes

.1 Adjustment of existing valve boxes will be measured on a unit basis and paid for at the Contract Unit price per unit for "Adjustment of Valve Boxes". The number of units to be paid for will be the total number of existing valve boxes adjusted in accordance with this specification, accepted and measured by the Contract Administrator.

4.8 Valve Box Extensions

.1 Valve box extensions will be measured on a unit basis and paid for at the Contract Unit price per unit for "Valve Box Extensions". The number of units to be paid for will be the total number of valve box extensions supplied and installed in accordance with this specification, accepted and measured by the Contract Administrator.

4.9 Adjustment of Curb Stop Boxes

.1 Adjustment of existing curb stop boxes will be measured on a unit basis and paid for at the Contract Unit Price per unit for "Adjustment of Curb Stop Boxes". The number of units to be paid for will be the total number of existing curb stop boxes adjusted in accordance with this Specification, accepted and measured by the Contract Administrator.

.1 Supply curb stop extensions in accordance with Section 4.8 of the specification.

4.10 Curb Stop Extensions

.1 Curb stop extensions will be measured on a unit basis and paid for at the Contract Unit price per unit for "Curb Stop Extensions". The number of units to be paid for will be the total number of curb stop extensions supplied and installed in accordance with this specification, accepted and measured by the Contract Administrator.

4.11 Lifter Rings

.1 Lifter rings will be measured on a unit basis and paid for at the Contract Unit Price per unit for the "Items of Work" listed here below. The number of units to be paid for will be the total number of lifter rings supplied and installed in accordance with this specification, accepted and measured by the Contract Administrator.

Lifter Rings:

i.) 38mm
ii.) 51mm
iii.) 64mm
iv.) 76mm

4.12 Adjustment of Traffic Signal Service Box Frames

.1 Adjustment of existing service box frames will be measured on a unit basis and paid for at the Contract Unit price per unit for "Adjustment of Traffic Signal Service Box Frames". The number of units to be paid for will be the total number of existing or new traffic signal service box frames adjusted in accordance with this specification, accepted and measured by the Contract Administrator.

CW 3230 – FULL-DEPTH PATCHING OF EXISTING PAVEMENT SLABS AND JOINTS

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CW 3230 – FULL-DEPTH PATCHING OF EXISTING PAVEMENT SLABS AND JOINTS

1. GENERAL CONDITIONS

The General Conditions and Standard Provisions attached hereto shall apply to and be a part of this Specification.

2. DEFINITION

2.1 Full Slab Replacement

One or more slabs, to a maximum of five (5) consecutive slabs, in which the patch area is defined by the existing perimeter of the slab(s). If more than five (5) consecutive slabs require replacement, pavement removal shall be done and paid for in accordance with Specification CW 3110 and construction of Portland cement concrete pavement shall be done and paid for in accordance with Specification CW 3310.

2.2 Partial Slab Patch

Any portion of slab or slabs in a single lane in which the patch area requires a saw-cut along at least one side to define the perimeter of the patch. Patches spanning both sides of a longitudinal joint will be considered as one patch only if the patch can be done as one pour; if the longitudinal joint is repaired one lane-at-a-time, it shall be considered as two patches.

3. DESCRIPTION

This Specification shall cover all operations relating to full-depth patching of concrete pavement slabs and joints, and private approaches.

The work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies and all other things necessary for and incidental to the satisfactory performance and completion of all work as hereinafter specified.

5. MATERIALS

5.1 General

The Contractor shall be responsible for the supply, safe storage and handling of all materials set forth in this Specification.

5.2 Handling and Storage of Materials

All materials shall be handled in a careful and workmanlike manner, to the satisfaction of the Contract Administrator.

5.3 Testing and Approval

All materials supplied under this Specification shall be subject to inspection and testing by the Contract Administrator or by the Testing Laboratory designated by the Contract Administrator. There shall be no charge to the City for any materials taken by the Contract Administrator for testing purposes.

The Contract Administrator shall approve all materials before any construction is undertaken. If, in the opinion of the Contract Administrator, such materials, in whole or in part, do not conform to the Specification detailed herein or are found to be defective in manufacture or have become damaged in transit, storage or handling operations, then such materials shall be rejected by the Contract Administrator and replaced by the Contractor at his own expense.

5.4 Concrete Materials

All concrete materials shall conform to the requirements of Sections 5 and 6 of Specification CW 3310.

5.5 Dowels

Dowels shall be Grade 300 plain bars, with the ends of the dowels free of burs and distortion.

5.6 Tie Bars

Tie bars shall be Grade 300 deformed bars.

5.7 Epoxy-Coating

Unless otherwise specified in the Specifications for the Work, tie bars and dowels shall be shop coated with epoxy conforming to the requirements of ASTM Standard D3963. All visible defects in the epoxy coating shall be field-coated with epoxy touch-up paint.

5.8 Bonding Agent

Epoxy resin shall be of a type listed in the Approved Products for Surface Works, conforming to the requirements of ASTM Standard C881. Type 1, Grade 3 epoxy shall be used for bonding tie bars and dowels into hardened concrete.

Bonding agents for bonding tie bars and dowels into holes in hardened concrete other than epoxy resin may be permitted provided that they develop a minimum pullout resistance of 50 kN within 48 hours after installation. Alternative bonding agents are listed in the approved products list.

5.9 Miscellaneous Materials

Miscellaneous materials shall be of the type specified on the Drawings and approved by the Contract Administrator.

8. EQUIPMENT

8.1 Drills

Drills used to make holes for installing dowels shall be held in a rigid frame.

9. CONSTRUCTION METHODS

9.1 Pavement Removal

When an entire pavement slab is being replaced, care shall be taken to ensure that the remaining pavement along the joints is not chipped or broken.

Where only a portion of a pavement slab is being replaced, the Contractor shall saw-cut the pavement surface along the perimeter of the area designated for removal.

Where the finished pavement shall be a concrete surface, the pavement shall be double cut. First, saw-cut to full-depth, a single cut along the perimeter of the area designated for removal. Then cut full depth a second saw cut, 150mm inside the first cut. Should the adjacent pavement chip, spall or otherwise be damaged, the Contractor shall re-saw cut the pavement edge and remove the damaged concrete to the Contract Administrator's satisfaction.

When the concrete pavement or concrete base exceeds 200 mm in thickness, a 200 mm saw cut will be considered full-depth. Alternately, and where approved by the Contract Administrator, the pavement shall be saw cut to a minimum depth of 50 mm.

Where the perimeter of a patch is within 1000 mm of a joint or the pavement edge, the area to be patched shall be extended to the edge of the pavement slab.

The Contractor shall remove the existing deteriorated concrete within the patch area by carefully breaking down and removing deteriorated concrete, or for full-depth cuts only, by lifting out the deteriorated pavement in one piece.

Removal of deteriorated concrete shall be done in such a manner that the adjacent pavement is not damaged. The edge of the adjacent pavement shall be a vertical face. Where the edge of adjacent pavement is spalled at the surface or undercut below the surface by the removal operation, the Contractor shall re-saw the adjacent pavement beyond the limit of the spalled or undercut pavement area and remove the damaged concrete. This additional patching shall be carried out at the expense of the Contractor.

When an asphalt overlay will be placed over the full depth repairs, the pavement shall be single cut full depth. Up to 35 millimetre wide chips or spalls along the edge of the adjacent pavement will be allowed. No additional saw cutting and removal will be required. When chips or spalls are greater than 35 millimetres in width, the pavement shall be re-saw cut with a single full depth cut to the Contract Administrator's satisfaction.

When concrete curb forms part of the concrete pavement designated for removal, the curb shall be removed prior to the saw cutting of the designated patch area, and paid for in accordance with Specification CW 3240.

Disposal of material shall comply with the requirements of Section 9.5 of this Specification.

9.2 Base Preparation

Excavation of existing in-site material, sub-grade preparation, and sub-base construction, if authorized by the Contract Administrator, shall be supplied, placed, and paid for separately in accordance with Specification CW 3110 and the Standard Details.

Where required as a leveling course, a maximum thickness of 50 mm of approved material shall be supplied, and placed in accordance with Specification CW 3110. Additional base course required by the contract administrator, shall be supplied, placed, and paid for in accordance with Specification CW 3110.

No payment shall be made for leveling course.

Where existing base is adequate, it shall be mechanically compacted to the satisfaction of the Contract Administrator. The cost of compaction shall be incidental to the cost of the patching.

9.3 Placement of Reinforcing Steel, Dowels and Tie Bars

The Contractor shall supply reinforcing steel in conformance with Specification CW 3310 and the Drawings.

The Contractor shall drill holes into adjacent slabs for dowels and tie bars of the diameters and depths shown on the Standard Details. Drill bits shall have a diameter no larger than 2 mm larger than the nominal dowel or tie bar diameter.

Holes shall be located at mid-depth of the slab and spaced as indicated on the Drawings.

Drilling equipment shall be operated so as to ensure that no damage to the pavement results from such drilling operation.

Holes for dowels and tie bars shall be blown clean with compressed air. Bonding agent shall be placed in the back of the drilled hole. The dowel or tie bar shall be worked back into the holes for complete coverage around the portion of the bar that extends into the hole, such that bonding agent is squeezed from the hole.

Dowels shall be installed parallel to one another and to the longitudinal direction of the pavement. A maximum tolerance of 5 mm in the vertical and horizontal direction over the length of the dowel is permitted.

Following installation of dowels, the ends of the dowels that extend into the patch area shall be completely coated with MC 250 asphaltic cut back.

Where dowel assemblies are to be placed across transverse joints, they shall be installed and paid for in accordance with Specification CW 3310.

Once all reinforcing steel is in position, it shall be inspected and approved by the Contract Administrator before any concrete is placed. Otherwise the concrete may be rejected by the Contract Administrator and shall be removed by the Contractor at his own expense.

9.4 Placing Full-Depth Patches

Forms shall be used on all exposed edges of the patch, placed in accordance with the requirements of Specification CW 3310.

Placing, consolidation, finishing, curing and sealing shall comply with the requirements of Specification CW 3310, with the following exceptions:

Each patch shall be placed in one continuous full-depth operation.

Short patches less than 3.5 metres in the longitudinal direction shall be screeded either perpendicular or, where adjacent pavement is worn, parallel to the longitudinal direction. For lane-width patches greater than 3.5 metres long, the screed shall be placed perpendicular to the longitudinal direction.

Lane-width patches greater than 3.5 metres in length which are to be finished flush with adjacent pavement shall be finished with a suitable finishing machine that has at least one vibrating screed.

All patches finished flush with adjacent pavement shall be straight-edged. While the concrete is still plastic, the surface of the patch shall be checked with a 3 metre long metal straight edge. The straight edge shall be in contact with the existing pavement while drawing it across the patch. Any depressions or high spots exceeding 5 mm shall be immediately corrected.

Where a transverse joint is included in a concrete patch and is not aligned with transverse joints in adjacent lanes, tie bars shall be omitted and a bond breaker installed along the longitudinal joint between the transverse joint of the adjacent lane or lanes and the nearest transverse edge of the patch.

Where the distance along the longitudinal joint between the transverse joints in the adjacent lane to the closest end of a concrete patch exceeds one metre, both ends of the new patch shall be tied and a transverse joint saw-cut in the original location and sealed in accordance with the requirements of Specification CW 3310.

Where required, the curb shall be constructed such that it will be consistent with adjacent existing curb, either separate or integral. The curb renewal shall be done and paid for in accordance with Specification CW 3240.

9.5 Disposal of Material

Disposal of material shall be understood to mean the removal of a material from the site, hauling of the material along a route approved by the Contract Administrator and the unloading and grading of the material in a manner satisfactory to the Contract Administrator at a legal disposal site.

If a disposal site is not otherwise indicated in the Specifications for the Work, the Contractor shall locate a legal disposal site and identify a haul route to be approved by the Contract Administrator.

Material dropped or spilled on any street during the hauling operations shall be promptly cleaned up by and at the expense of the Contractor, to the satisfaction of the Contract Administrator.

9.6 Maintenance of Traffic

The renewal of sections of pavement slab must proceed in such a manner as to conform to the requirements for maintenance of traffic as set out in the Standard Provisions or as directed by the Contract Administrator.

9.7 Opening to Traffic

In no case shall traffic or construction equipment be allowed on reconstructed sections of Portland cement concrete pavement until the concrete has reached a minimum compressive strength of 20 MPa.

10. QUALITY CONTROL

10.1 Inspection

All workmanship and all materials furnished and supplied under this Specification are subject to close and systematic inspection and testing by the Contract Administrator including all operations from the selection and production of materials through to 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 Contract Administrator reserves the right to reject any materials or works that are not in accordance with the requirements of this Specification.

10.2 Corrective Action

The Contractor shall, at his own expense, correct such work or replace such materials found to be defective under this Specification in an approved manner to the satisfaction of the Contract Administrator.

11. QUALITY ASSURANCE

11.1 Quality Assurance Testing

Concrete Tests shall be in done in accordance with CSA A23.2

The Contract Administrator shall ensure the number and frequency of quality assurance tests as follows:

One concrete test shall consists of:

Slump test
Air test
One lab cure cylinder – 7 day break
Two lab cure cylinders – 28 day break

The minimum testing frequency per day for each mix design, shall be as follows:

- If less than 8 cu.m. of concrete per day: One test

- 8 or more cu.m per day per mix design:
  One test on the first truck then one test every 50 cu.m. or part thereof, with a minimum of 2 tests per day.

If any air or slump test fails for any concrete load in the day's pour, continue to test slump and air on succeeding trucks until consistency is established.

Additional testing shall be as directed by the Contract Administrator. To establish the field strength for early opening of pavement, take additional field cure cylinders with the break time to match the concrete mix.

11.2 Test Failure

Concrete that fails to meet the requirements of CW 3310 for slump or air shall be retested. If the second test fails to meet the requirements of CW 3310 for slump or air, the load of concrete shall be rejected by the Contractor.

12. METHOD OF MEASUREMENT

12.1 Full Slab Replacement

Replacement of complete slabs will be measured on a surface area basis. The surface area to be paid for shall be the total number of square metres removed and replaced in accordance with this Specification and accepted by the Contract Administrator, as computed from measurements made by the Contract Administrator.
Replacement of partial slabs adjoining complete slabs will be measured in accordance with Clause 12.2 of this Specification.

12.2 Full-Depth Partial Slab Patches

Full-depth partial slab patches will be measured on a surface area basis and classified in accordance with the following dimensions:

TABLE 1
CW 3230-R4.1

Class of Patch	Patch Area (m^2)	x = Shortest Patch Dimension (m)
A	less than or equal to 3.0	$x \geq 1.0$
B	over 3.0	$1.8 \geq x \geq 1.0$
C	less than or equal to 8.0	$x > 1.8$
D	greater than 8.0	$x > 1.8$

The surface area to be paid for shall be the total number of square metres removed and replaced in accordance with this Specification and accepted by the Contract Administrator. Any patch that is less than 1.0 square metre in area will be measured as 1.0 square metre.

12.3 Dowels in Drilled Holes

Installation of dowels into hardened concrete will be measured on a unit basis. The number to be paid for shall be the total number of dowels of specified diameters supplied and installed in accordance with this Specification and accepted by the Contract Administrator.

12.4 Tie Bars in Drilled Holes

Installation of tie bars into hardened concrete will be measured on a unit basis. The number to be paid for shall be the total number of tie bars of specified diameters supplied and installed in accordance with this Specification and accepted by the Contract Administrator.

13. BASIS OF PAYMENT

13.1 Full Slab Replacement

Replacement of complete slabs will be paid for at the Contract Unit Price per square metre for the "Items of Work" listed here below, measured as specified herein, which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the work included in this Specification.

Items of Work: Slab Replacement

i. 250mm Concrete Pavement (**)
ii. 230mm Concrete Pavement (**)
iii. 200mm Concrete Pavement (**)
iv. 150mm Concrete Pavement (**)
** Specify either Reinforced or Plain-Dowelled

13.2 Full Depth Partial Slab Patches

Full-depth partial slab patches will be paid for at the Contract Unit Price per square metre for "Items of Work"*, listed here below, measured as specified herein, which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the work included in this Specification.

Items of Work: Partial Slab Patches *

i. 250mm Concrete Pavement
ii. 230mm Concrete Pavement
iii. 200mm Concrete Pavement
iv. 150mm Concrete Pavement
* Specify class of patch

13.3 Dowels in Drilled Holes

Installation of dowels into hardened concrete will be paid for at the Contract Unit Price for "Drilled Dowels"*, measured as specified herein, which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the work included in this Specification.

*Specify diameter(s) of dowels

13.4 Tie Bars in Drilled Holes

Installation of tie bars into hardened concrete will be paid for at the Contract Unit Price for "Drilled Tie Bars"* measured as specified herein, which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the work included in this Specification.

*Specify size(s) of tie bars.

CW 3240 – RENEWAL OF EXISTING CURBS

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CW 3240 – RENEWAL OF EXISTING CURBS

1. DESCRIPTION

1.1 General

.1 This specification covers the removal, installation and renewal of existing curbs, curb and gutter sections and splash strips.

1.2 Definitions

.1 Concrete Curb Renewal – existing curbs, curb and gutter sections and splash strips removed and reinstalled for grade revisions or improving their condition in the same location.

.2 Curb Reveal Height – That portion of the curb above the finished surface of the asphalt or concrete pavement.

.3 Curb Ramp – Combined curb taper and depressed curb.

1.3 Referenced Standard Construction Specifications

.1 CW 1130 – Site Requirements.
.2 CW 3110 – Sub-Grade, Sub-Base and Base Course Construction.
.3 CW 3230 – Full-Depth Patching of Existing Slabs and Joints.
.4 CW 3310 – Portland Cement Concrete Pavement Works.
.5 CW 3410 – Asphaltic Concrete Pavement Works.
.6 CW 3450 – Planing of Pavement.
.7 Approved Products for Surface Works.

1.4 Referenced Standard Details

.1 SD-200 – Curb and Gutter.
.2 SD-201 – Mountable Curb.
.3 SD-202A – 75mm Lip Curb.
.4 SD-202B – 40mm Lip Curb.
.5 SD-202C – Modified Lip Curb.
.6 SD-203A – Barrier Curb (separate).
.7 SD-203B – Modified Barrier Curb.
.8 SD-204 – Barrier Curb (integral).
.9 SD-205 – Barrier Curb (dowelled).
.10 SD-206A – Barrier Curb Replacement.
.11 SD-206B – Safety Curb.
.12 SD-223A – Monolithic Concrete Splash Strip
.13 SD-223B – Separate Concrete Splash Strip
.14 SD-229A – Curb Ramp for 1500 Sidewalk at Intersections
.15 SD-229B – Curb Ramp for Full Width Sidewalk at Intersections.
.16 SD-229BA – Curb Ramp Layout for Medians, Lanes, and Commercial Approaches
.17 SD-229C – Curb Ramp for Concrete Pavement.
.18 SD-229D – Curb Ramp for Asphalt Pavement
.19 SD-229E – Curb Ramp and Depressed Curb with Detectable Warning Surface Tile.

2. MATERIALS

2.1 Bonding Agents

.1 Supply bonding agents for installing tie bars and curb reinforcing steel into existing concrete

pavements in accordance with ASTM C881. Bonding agents will be Type I, Grade 3 Epoxy Resins.

.2 Bonding agents other than epoxy resins must be capable of developing a minimum pull out resistance of 50 kN, 48 hours after installation.

.3 Use only those materials listed as Approved Products for Surface Works. The Approved Products are available in Adobe Acrobat (.pdf) format at the City of Winnipeg, Corporate Finance, Material Management Internet site at: http://www.winnipeg.ca/matmgt/info.stm

2.2 Concrete Materials

.1 Supply concrete materials in accordance with Sections 5 and 6 of CW 3310.

2.3 Reinforcing Steel

.1 Supply curb reinforcing steel in accordance with Clauses 5.4.4 and 5.4.5 of CW 3310.

2.4 Asphalt Material

.1 Asphalt material will be Type 1A and will be supplied in accordance with Sections 5 and 6 of CW 3410.

3. CONSTRUCTION METHODS

3.1 Concrete Curb Removal

.1 Remove concrete curbs, curb and gutter sections and splash strips at locations as shown on the Drawings or as directed by the Contract Administrator.

.2 Saw-cut existing curbs, curb and gutter sections and splash strips full-depth at the designated removal limits.

.3 Remove existing asphalt material immediately in front of the curb that is required for installation when the asphalt overlay is not identified to be removed.

.4 Ensure the removal methods do not chip or damage pavement, curb and splash strips to remain.

.5 Resaw-cut damaged or chipped curbs and splash strips beyond the removal limits.

.6 Remove damaged curb reinforcing as directed by the Contract Administrator.

.7 Dispose of removed curb, curb and gutter sections and splash strips in accordance with Section 3.4 of CW 1130.

3.2 Lip Curb Removal

.1 Remove existing concrete lip curb by planing methods at the locations as shown on the Drawings or as directed by the Contract Administrator.

.2 Removal by planing methods is only applicable for integral lip curbs.

.3 Plane to within 5 millimetres of the top of the existing pavement or as directed by the Contract Administrator.

.4 Ensure the existing pavement surface is not damaged by the planing operation.

.5 Utilize planing equipment in accordance with CW 3450.

.6 Saw-cut existing curbs within 150 millimetres of the designated limits and remove by hand methods to the satisfaction of the Contract Administrator.

.7 Dispose of planing material in accordance with Section 3.4 of CW 1130.

3.3 Concrete Curb Installation

.1 Install curbs at locations as shown on the Drawings or as directed by the Contract Administrator.

.2 Excavate only material immediately behind curbs that is required for installation to a maximum distance of 150 millimetres.

.3 Install new reinforcing steel and tie-bars as shown on the Standard Details. Provide a minimum of 40 millimetres cover between reinforcing steel and the finished concrete surface.

.4 Clean concrete pavement surfaces immediately prior to the curb installation to the satisfaction of the Contract Administrator.

.5 Apply bonding grout in accordance with CW 3310.

.6 Install curb and gutters in accordance with SD-200.

.7 Install mountable curbs in accordance with SD-201.

.8 Install lip curbs in accordance with SD-202A, SD-202B and SD-202C.

.9 Install barrier curbs in accordance with SD-203A, SD-203B, SD-204, SD-205 and SD-206A.

.10 Install safety curb in accordance with SD-206B.

.11 Install curb ramps in accordance with SD-229A, SD-229B, SD-229BA, SD-229C, SD-229D and SD-229E.

.12 Install splash strips in accordance with SD-223A and SD-223B. When the total curb height exceeds 250millimetres, the Contractor has the option to shape the base course in accordance with SD-223A.

.13 Place concrete in accordance with Specification CW 3310.

.14 Lower curb height at localized areas as directed by Contract Administrator to provide boulevard drainage.

.15 For complete renewal, install curbs, curb and gutter sections and splash strips utilizing slip-form paving equipment unless otherwise directed by the Contract Administrator.

.16 Place and compact asphalt material immediately in front of the curb to the satisfaction of the Contract Administrator when the asphalt overlay is not identified to be removed.

.17 Place and compact suitable backfill material behind the curbs to the satisfaction of the Contract Administrator.

3.4 Concrete Curb Renewal

.1 Remove and install concrete curb at locations as shown on the Drawings or as directed by the Contract Administrator.

.2 Remove curbs in accordance with Sections 3.1 and 3.2 of this specification.

.3 Install curbs in accordance with Section 3.3 of this specification.

.4 Excavate, compact sub-grade, place a leveling course to a maximum thickness of 50 millimetres and suitable backfill materials in accordance with CW 3110 to a maximum distance of 150 millimetres beyond the back of the curb, curb and gutter or splash strip being renewed.

.5 When the total monolithic splash strip curb height exceeds 250millimetres, the Contractor has the option to shape the base course in accordance with SD-223A.

.6 Complete boulevard grading in accordance with CW 3110 as directed by the Contract Administrator to a maximum distance of 600 millimetres beyond the curb, curb and gutter or splash strip being renewed.

4. MEASUREMENT AND PAYMENT

4.1 Concrete Curb Removal

.1 Concrete curb removal will be measured on a length basis and paid for at the Contract Unit Price per metre for the "Items of Work" listed here below. The length to be paid for will be the total number of metres of concrete curb removed in accordance with this specification, accepted and measured by the Contract Administrator.

Items of Work:

Concrete Curb Removal
- i.) Barrier*
- ii.) Modified Barrier*
- iii.) Curb and Gutter
- iv.) Lip Curb
- v.) Curb Ramp
- vi.) Safety Curb
- vii.) Splash Strips**

* Integral or Separate to be specified.
** Monolithic or Separate.

.2 Removal of existing asphalt material immediately in front of the curb that is required for installation will be included in the payment for the "Items of Work" listed for Concrete Curb Removal when the asphalt overlay is not identified to be removed.

4.2 Concrete Curb Installation

.1 Concrete curb installation will be measured on a length basis and paid for at the Contract Unit Price per metre for the "Items of Work" listed here below. The length to be paid for will be the total number of metres of concrete curb or splash strip installed in accordance with this specification, accepted and measured by the Contract Administrator.

Items of Work:

Concrete Curb Installation
- i.) Barrier*
- ii.) Modified Barrier*
- iii.) Curb and Gutter*
- iv.) Mountable Curb*
- v.) Lip Curb*
- vi.) Modified Lip Curb*

vii.) Curb Ramp*
viii.) Safety Curb*
ix.) Splash Strips**

* reveal height, type and reference to Standard Detail to be specified.
** reveal height, monolithic or separate, type, width and reference to Standard Detail to be specified.

.2 The placement and compaction of asphalt material immediately in front of the curb will be included in the payment for the "Items of Work" listed for Concrete Curb Installation when the asphalt overlay is not identified to be removed.

.3 No payment will be made for leveling course.

.4 Base course will be paid in accordance with CW 3110.

.5 Supply and placement of bonding grout for concrete curbs will not be measured for payment.

4.3 Concrete Curb Renewal

.1 Concrete curb renewal will be measured on a length basis and paid for at the Contract Unit Price per metre for the "Items of Work" listed here below. The length to be paid for will be the total number of metres of concrete curb or splash strip removed and installed in accordance with this specification, accepted and measured by the Contract Administrator.

Items of Work:

Concrete Curb Renewal
i.) Barrier* (**)
ii.) Modified Barrier*
iii.) Curb and Gutter* (**)
iv.) Mountable Curb*
v.) Lip Curb*
vi.) Modified Lip Curb*
vii.) Curb Ramp*
viii.) Safety Curb*
ix.) Splash Strips (**) (***)

* reveal height, type and referenced Standard Detail to be specified.
(**) renewed length to be specified.
a.) Less than 3 m
b.) 3 m to 30 m
c.) Greater than 30 m
(***) reveal height, monolithic or separate, type, width and reference to Standard Detail to be specified.

.2 All costs for removal, excavation, sub-grade compaction, leveling course and backfill materials, curb installation and boulevard grading to the limits as identified in Section 3.4 of this specification will be included in the payment for the "Items of Work" listed for Concrete Curb Renewal.

.3 Base course will be paid in accordance with CW 3110.

.4 For installation lengths greater than 30 metres, the length will include breaks for approaches, isolations or fixed obstacles such as light standards or poles.

.5 Curb ramp tie bars are to be paid in accordance with CW 3230.

.6 Supply and placement of bonding grout for concrete curbs will not be measured for payment.

CW 3310 - PORTLAND CEMENT CONCRETE PAVEMENT WORKS

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CW 3310 - PORTLAND CEMENT CONCRETE PAVEMENT WORKS

1. DESCRIPTION

CW 3310 shall cover the preparation of Portland Cement Concrete for, and all concreting operations relating to, the construction of Portland Cement Concrete pavements, curbs, gutters, private approaches, bull-noses, median slabs, median, safety median and boulevard splash strips, sidewalk and other related concrete works. This Specification is applicable to both reinforced and non-reinforced concrete construction, but not pre-stressed concrete.

The work to be done by the contractor under this Specification shall include the supply of all materials, and the furnishing of all superintendence, overhead, labour, equipment, tools, supplies and all other things necessary for and incidental to the satisfactory performance and completion of all work as hereinafter specified.

2. DEFINITIONS

2.1 Reinforced Concrete Pavement

A Portland Cement Concrete pavement with distributed steel reinforcement in the pavement slab and with deformed tie bars across longitudinal joints. Distributed steel reinforcement consists of smooth or deformed bars, with the longitudinal smooth dowels extended across the transverse contraction joints. Contraction joint spacing is typically 5 metres.

2.2 Plain-Dowelled Pavement

A Portland Cement Concrete pavement with no reinforcing steel in the pavement slab and with deformed tie bars across longitudinal joints and smooth dowels across transverse contraction joints. Contraction joint spacing is typically 5 metres.

2.3 Coarseness Factor

A measure of the coarseness of the combined aggregate materials being incorporated into the concrete mix, defined as the percentage of all plus 2 500 sieve particles, which are also retained on the 10 000 sieve.

Coarseness Factor = 100 (cumulative % retained on 10 000 Sieve divided by the cumulative % retained on 2 500 Sieve).

5. MATERIALS

5.1 Handling and Storage of Materials

Storage of materials shall be in accordance with the requirements of CSA-A23.1, Clause 9, Storage of Materials, except as otherwise specified herein.

5.2 Testing and Approval

All materials supplied under this Specification shall be subject to inspection and testing by a Testing Laboratory designated by the City of Winnipeg, Research and Standards Engineer or the Contract Administrator. There shall be no charge for any materials taken for testing purposes.

All materials shall conform to CSA-A23.1.

5.3 Portland Cement Concrete Constituent Materials

5.3.1 Aggregates

The Concrete Supplier shall provide in writing to the City of Winnipeg, Research and Standard Engineer, the location of the sources where aggregate will be obtained. Changes in the source of aggregate supply will not be permitted without approval of the City of Winnipeg, Research and Standards Engineer.

Aggregates shall conform to CSA-A23.1, Section 5, Aggregates. The following tests shall be conducted on each aggregate and the test results shall be provided with the mix design submittal.

Material	Parameter	Test Method	Specifications Limit	Frequency of Test
coarse aggregate	petrographic examination – PN	ASTM C295 MTO LS 609	125 max	1 year
	LA abrasion loss	CSA A23.2-16A	35% max	1 year
	unconfined freeze-thaw	CSA A23.2 24A	6% max	1 year
	Micro-Deval	CSA A23.2-29A	17% max	1 year
	clay lumps	CSA A23.2-3A	0.25% max	2 years
	low density granular material	CSA A23.2-4A	0.5% max	2 years
	alkali-silica reactivity	CSA A23.2-25A	0.15% max	2 years
fine aggregate	petrographic examination	ASTM C295	see note	1 year
	Micro-Deval	CSA A23.2-23A	20% max	1 year
	clay lumps	CSA A23.2-3A	1% max	2 years
	low density granular material	CSA A23.2-4A	0.5% max	2 years
	alkali-silica reactivity	CSA A23.2-25A	0.15% max	2 years
	organic impurities	CSA A23.2-7A	free from injurious amounts	2 years

NOTE:

The petrographic report for the fine aggregate shall include a comment on the suitability of the material for use in the production of concrete paving mix.

For concrete mix designs that will utilize two coarse aggregates and both coarse aggregates are from the same source, only the larger nominal maximum size coarse aggregate shall be tested for the parameters shown in the table above. If the coarse aggregates are from different sources, both materials shall be tested for the parameters shown in the table above.

The Coarseness Factor of the combined aggregate shall be between 45 and 65.

Quarried limestone and dolomite shall not be acceptable as aggregate materials.

The combined grading for the concrete aggregates shall comply with the following requirements:

TABLE 1
CW 3310-R6.1

TABLE 1 Design Combined Aggregate Gradation Limits		
Sieve Size	**Type 1 - All Portland Cement Concrete, except for Sidewalks**	**Type 2 - Portland Cement Concrete Sidewalks**
28 000	100%	100%
20 000	90% - 100%	90% - 100%
14 000	75% - 95%	75% - 95%
10 000	60% - 75%	60% - 75%
5 000	35% - 50%	35% - 55%
2 500	27% - 35%	27% - 40%
1 250	20% - 30%	20% - 35%
630	10% - 20%	10% - 20%
315	5% - 10%	5% - 10%
160	1% - 4%	1% - 4%
80	0% - 2%	0% - 2%

5.3.2 Cement

All cement shall be Type GU General Use Hydraulic conforming to the requirements of CSA A3001, Portland Cement. Cement shall be kept in weather tight storage that will protect it from moisture and contamination, and in such a manner as to permit inspection, sampling and identification, where required, of each lot.

Check tests of the cement may be undertaken by a Testing Laboratory designated by the City of Winnipeg, Research and Standards Engineer. Any cement which fails to comply with the requirements of CSA A3001 will be rejected, notwithstanding any certificate of acceptance that may have been previously given. Cement that has been rejected must be removed immediately by the Concrete Supplier.

5.3.3 Supplementary Cementing Materials

Fly ash for use in Portland Cement Concrete shall conform to the requirements of CSA A3001 for Class CI fly ash, except that the maximum allowable loss on ignition shall be three (3%) percent.

Fly ash shall be sampled and tested with copies of test results submitted to the City of Winnipeg, Research and Standards Engineer.

Fly ash shall be added to concrete mixtures as a separate constituent material. The use of blended hydraulic cement is not permitted.

5.3.4 Water

Water used for concrete mixing water shall conform to ASTM C1602M, Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete. The concrete supplier shall maintain documentation on the characteristics of the mixing water in compliance with the

requirements of Tables 1 and 2 in ASTM C1602M. Testing to verify compliance with the requirements in Table 1 shall be conducted on the Type 1 hand placement paving mix with fly ash. The testing frequency for mixing water shall be in accordance with Appendix X1 of ASTM C1602M. Information on the testing frequency of the concrete mixing water shall be included in the concrete suppliers' quality control program. The source(s) of concrete mixing water and test data indicating compliance with ASTM C1602M shall be provided with the Mix Design Statement submitted to the City of Winnipeg Research and Standards Engineer.

5.3.5 Admixtures

No admixture, other than Air-Entraining Agent and Type WN Water-Reducing Agent shall be used without the written authorization of the City of Winnipeg, Research and Standards Engineer, unless otherwise specified in the Specifications for the Work.

a) Air-Entraining Admixture

The air-entraining admixture shall conform to the requirements of ASTM C260.

b) Chemical Admixtures

Chemical admixtures shall conform to the requirements of ASTM C494. Chloride-based chemical admixtures will not be permitted under any circumstances.

5.4 Incidental Materials

5.4.1 Hot Poured Joint Sealer

Hot poured joint sealer shall be low modulus Type IV Material Conforming to the requirements of ASTM Standard D 6690-01, Specification for Joint and Crack Sealants, Hot-poured, for Concrete and Asphalt Pavements.

Use only those materials listed as Approved Products for Surface Works. The Approved Products are available in Adobe Acrobat (.pdf) format at the City of Winnipeg, Corporate Finance, Material Management Internet site at: http://www.winnipeg.ca/matmgt/info.stm

5.4.2 Preformed Neoprene Compression Joint Seals

Use of preformed neoprene joint seals are subject to the approval of the Contract Administrator. Preformed neoprene compression joint seals are to be used on transverse joints only and are to be installed according to the manufacturer's recommendations. Preformed neoprene compression joint seals must meet ASTM Standard D2628.

5.4.3 Expansion / Isolation Joint Filler

a) Fibre Joint Filler

Fibre joint filler shall be rot-proof and of the preformed, non-extruding, resilient type made with a bituminous fibre and shall conform to the requirements of ASTM Standard D1751, Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction.

b) Plastic Joint Filler

Plastic Expansion Joint Filler is to be the fluted polypropylene type and 6 mm in thickness.

5.4.4 Reinforcing Steel

Reinforcing steel shall be deemed to include all reinforcing bars, tie bars, dowel bars and bar mat reinforcement, including all bar accessories.

All reinforcing steel shall be supplied according to the type and dimensions as shown on the Contract Drawings or the Standard Details.

All reinforcing steel shall conform to the requirement of CSA Standard G30.12, Billet-Steel Bars for Concrete Reinforcement. If, in the opinion of the Contract Administrator, any reinforcing steel provided for the concrete works exhibits flaws in manufacture or fabrication, such material shall be immediately removed from the site and replaced with acceptable reinforcing steel.

a) Bar Mat Reinforcement shall be Grade 300 bars with all bar intersections welded by an electric resistance spot welder, Welding shall be done in such a manner that the minimum requirements for tensile strength and yield point of the reinforcing steel shall be met when a specimen is tested across points of weld.

   Longitudinal bars shall be plain bars. Transverse bars may be plain bars or deformed bars.

   Bar mats with defective spot welds or with spot welds that have been broken while in transit, or during handling or placing operations, shall be replaced or repaired to the satisfaction of the Contract Administrator prior to installation.

b) Deformed Reinforcing Bars and Tie Bars shall be Grade 300 deformed bars.

c) Dowel Bars shall be Grade 300 plain bars.

d) Bar Accessories shall be of a type approved by the Contract Administrator.

All reinforcing steel shall be straight and free from paint, oil, mill scale and injurious defects. Rust, surface seams, or surface irregularities will not be cause for rejection provided that the minimum dimensions, cross-sectional area and tensile properties of a hand wire-brushed specimen are not less than the requirements of CSA Standard G30.12M.

5.4.5 Epoxy-Coating

For all new construction, or where specified; tie bars, dowels and stirrups (for separate curbs) shall be shop-coated with epoxy conforming to the requirements of ASTM Standard D3963. All bar ends shall be free of burs and distortions. All visible defects in the epoxy coating shall be field-coated with epoxy.

5.4.6 Liquid Membrane-Forming Curing Compound

Curing compound shall be Type 2, white-pigmented, and water based liquid membrane-forming curing compound conforming to the requirements of ASTM Standard C309.

5.4.7 Polyethylene Film

Polyethylene film shall be clear or white opaque and conform to the requirements of ASTM Standard C171.

5.4.8 Bonding Agent

Epoxy resin shall be of a type listed in the approved products list conforming to the requirements of ASTM Standard C881. Type 1, Grade 3 epoxy shall be used for bonding tie bars and dowels into hardened concrete.

Bonding agents for bonding tie bars and dowels into holes in hardened concrete other than epoxy resin may be permitted provided that they develop a minimum pullout resistance of 50 kN within two days (48 hours) after installation. Alternative bonding agents are listed in the approved products list.

5.4.9 Form Coating

Form coating shall be of a type approved by the Contract Administrator.

5.4.10 Evaporation Retardant

Evaporation retardant shall be water based, the monomolecular type and shall be applied in accordance with the manufacturer's recommendations.

If the evaporation retardant application film is broken by brooming, tinning or other finishing procedures, the application film shall be reapplied.

5.4.11 Backer Rod

Backer rod shall be Type 1, heat-resistant, round foam rod sized to approximately 25% larger than joint width so as to employ wall tension to allow backer rod installation at required depth in accordance with ASTM D5249.

Acceptable Products will be:

- HBR XL as manufactured by NOMACO Inc. supplied by Road Products Manitoba Inc.
- Hot Rod XL as manufactured by Industrial Thermo Polymers Limited supplied by Brock White Canada, Johnson Construction Materials and Wearing Williams Limited.

or an approved equal.

5.4.12 Bonding Grout

.1 Bonding agent shall be Acryl-stix or approved equal as accepted by the Contract Administrator. Polyvinyl acetate-based latexes will not be permitted.

.2 The bonding grout shall be well mixed and will consist of the following constituents, by weight:

- 1 part water
- 1 part bonding agent
- 2 parts Type 10 Normal Portland Cement

.3 The consistency of the bonding grout shall be such that it can be applied in a thin, even coating on the slab so that it will not run or puddle in low spots.

6. DESIGN REQUIREMENTS

6.1 Mix Design Statement

6.1.1 General

The City of Winnipeg, Research and Standards Engineer will maintain a list of approved concrete suppliers. All submissions to The City of Winnipeg, Research and Standards Engineer must include a cover letter. The cover letter will clearly outline the purpose of the submission in the first paragraph (i.e., initial, annual, revised). The second paragraph must include a list of the documentation attached to the submission along with comments on test data and any other information. The comments should indicate whether the materials comply with the requirements of CW 3310. Standard forms available from The City of Winnipeg, Research and Standards Engineer must be used when submitting the following information:

- Constituent material list (aggregates, cement, fly ash, admixtures, water)
- Aggregate test data
- Concrete mix design list

6.1.2 Initial Submission

To obtain approval, concrete suppliers must submit the following information to the Research and Standards Engineer:

- Names of suppliers and sources for aggregates, cement and fly ash
- Names of manufacturers and products for admixtures with letter certifying that the admixtures comply with the relevant ASTM standards
- Concrete mix designs with unique mix design codes signed and dated by person selecting the mix proportions
- Copy of MRMCA certificate for concrete batch plant
- Copies of most recent scale calibration reports for the concrete batch plant
- Test data for aggregates (in accordance with clause 5.3.1)
- Test reports for the cement and fly ash that are representative of the materials to be used during concrete production.
- A minimum of five (5) sets of concrete compressive strength tests for the hand placement paving (Type 1) mix with and without fly ash and the sidewalk (Type 2) mix with and without fly ash to demonstrate the concrete mix will achieve the required strength level. The strength test data may be obtained from either Quality Control testing during production or trial batches.
- Air-void parameters for the Type 1 slipform paving mix. If fly ash is to be used in the concrete mix, air-void parameters shall be submitted for the Type 1 slipform paving mix with and without fly ash. The concrete will be considered to have a satisfactory air-void system if the spacing factor does not exceed 260 µm. In no case shall the tests be more than twelve (12) months old.
- Sieve analysis test reports for the individual aggregates and the combined aggregate gradations to be used in the Portland Cement Concrete. The sieve analysis test reports shall be representative of the material to be used during concrete production.
- Quality control program for all constituent materials and concrete mix.

6.1.3 Annual Submission

If a concrete supplier is on the approved concrete suppliers list and there are no changes in the sources of constituent materials and the concrete mix designs, the following information must be submitted prior to January 1:

- List of suppliers and sources of constituent materials
- List of concrete mix designs with unique mix design codes
- Summary of Aggregate Test Results (in accordance with clause 5.3.1)

- Current scale calibrations
- Air-void parameters for the Type 1 slipform paving mix. If fly ash is to be used in the concrete mix, air-void parameters shall be submitted for the Type 1 slipform paving mix with and without fly ash.
- Quality control program for all constituent materials and concrete mix

Updates for aggregate test data and MRMCA certificates must be provided prior to their expiry date to ensure the concrete supplier is maintained on the approved concrete suppliers list.

6.1.4 Revised Submission

If a concrete supplier is on the approved concrete suppliers list and there are changes in sources of the constituent materials, concrete mix designs or concrete plants, the relevant information must be forwarded for review and approval in accordance with the initial submission requirements. The following information is required for any change in constituent materials (cement, fly ash, aggregate or admixtures):

- For cement, fly ash and aggregates, name of new supplier and source.
- For admixtures, name of new manufacturer and product with a letter certifying that the admixtures comply with the relevant ASTM standards.
- A minimum of five (5) sets of concrete compressive strength tests for the hand placement paving (Type 1) mix with fly ash to demonstrate the concrete mix will achieve the required strength level. The strength test data may be obtained from either Quality Control testing during production or trial batches.
- Air-void parameters for the Type 1 slipform paving mix. If fly ash is to be used in the concrete mix, air-void parameters shall be submitted for the paving mix with and without fly ash.

In addition, the following information shall be submitted:

- For a change in cement or fly ash, test reports from suppliers that are representative of the materials to be used during concrete production.
- For a change in aggregate, test data for aggregates (in accordance with clause 5.3.1) and sieve analysis test reports for the individual and combined aggregates gradations to be used in the concrete.
- For a modification to an existing batch plant, a copy of the new MRMCA certificate and new scale calibrations.
- For a new batch plant that will use the same constituent materials as an existing batch plant, a copy of the MRMCA certificate and scale calibrations. A test report on the quality of the mixing water shall also be submitted if the source is not the City of Winnipeg water supply.

Once the design gradation has been approved, allowable deviations in gradation shall be as follows:

TABLE 2
CW 3310 – R6.2

Allowable Deviation From The Job Mix Formula	
Sieve Size	**Deviation in % By Mass Passing Sieve**
20 000	± 3%
14 000	± 4%
10 000	± 5%
5 000	± 5%
2 500	± 4%
1 250	± 4%
630	± 3%
315	± 3%
160	± 2%
80	± 1%

Once approved, all concrete shall be supplied in accordance with this Mix Design Statement.

No changes in the concrete mix designs will be permitted without following the above procedure.

6.2 Concrete Strength and Workability

In accordance with CSA A23.1, Alternative (1) for specifying concrete, the concrete mix shall be proportioned such as to yield concrete having the required strength and workability, as follows:

a) Type 1 - Concrete for Pavements, Commercial Approaches, Curb and Gutter Sections, Curbs, Monolithic Curb and Sidewalks, Splash Strips and Bull-noses:

i. Class of Exposure: C-2
ii. Minimum Specified Compressive Strength @ 28 days = 32 MPa
iii. Minimum Cementitious Content = 340 kg/m^3
iv. Maximum Water/Cementitious Ratio = 0.45
v. Slump = 50 ± 20 mm (for slip form paving)
= 70 ± 20 mm (for hand placement)
vi. Aggregate Size = 20 mm Nominal
vii. Air Content = 5.0% to 8.0%

* includes Plain Dowelled Pavements

b) Type 2 - Concrete for Sidewalks, Residential Approaches, Median Slabs and Other Related Concrete Works:

i. Minimum Specified Compressive Strength @ 28 days = 30 MPa
ii. Minimum Cementitious Content = 300 kg/m^3
iii. Maximum Water/Cement Ratio = 0.49
iv. Slump = 80 ± 20 mm
v. Aggregate Size = 20 mm Nominal
vi. Air Content = 5% to 8%

6.3 Restrictions on the Use of Fly Ash in Concrete

Class CI fly ash shall not replace Portland Cement by more than fifteen (15%) percent by mass of total cementitious content in the mix.

The use of fly ash as a partial replacement for Portland cement shall not be permitted between October 1 and May 15, unless authorized in writing by the City of Winnipeg, Research and Standards Engineer.

6.4 Concrete for Early Opening of Pavements

The Concrete Supplier shall modify the mix design, as required, in order to ensure that the minimum compressive strength of the concrete pavement is 20 MPa and is achieved within the following early opening requirements:

- 24 hours early opening after placement
- 72 hours early opening after placement

The Mix Design Statements for this concrete shall be submitted to the City of Winnipeg, Research and Standards Engineer for approval in accordance with Clause 6.1 of this Specification.

The requirements of Clause 6.2 shall also apply to concrete for early opening pavement.

6.5 Plant Quality Control

The Concrete Supplier shall provide quality control at the plant to ensure all materials meet the approved mix designs. The proposed quality control program shall be submitted with the Mix Design Statement for approval. This information shall be submitted weekly and will be monitored by the City of Winnipeg, Research and Standards Engineer.

6.6 Concrete For Temporary Restoration of Utility Pavement Cuts

The Concrete Supplier shall provide a mix design to be utilized for the temporary restoration of utility pavement cuts. The concrete placed shall be capable of supporting vehicular traffic loading within 24 hours of placement. The mix design requirements are as follows:

i. Minimum cement content = 300 kg/m3
ii. Slump = 120 ± 20 mm
iii. Air Content = 5% to 8%
iv. Aggregate Size = 20 mm

The grading for the concrete aggregate shall comply with the limits for Type 1 mix shown in Table 1 CW 3310-R6.1 in section 5.3.1. A calcium chloride based admixture meeting the requirements of ASTM C494 shall be used in the concrete mix to ensure adequate early age strengths are achieved.

The admixture dosage shall be adjusted during the year to accommodate changes in air temperatures. The admixture dosage will be dependent upon the Environment Canada minimum forecast temperature during the 24 hour period after concrete placement and will be as follows:

Minimum Curing Temperature after Concrete Placement	Calcium Chloride (based upon mass of cement)
Greater than 0^{0} C	1%
0 to -5^{0}C	2%
Less than -5 to -10^{0}C	3%
Less than -10^{0}C	4%

The Mix Design Statement for this concrete shall be submitted to the City of Winnipeg, Research and Standards Engineer for approval in accordance with Clause 6.1 of this Specification.

7. SUPPLY OF MATERIALS

7.1 Concrete Supply

All concrete supplied for Portland Cement Concrete pavement works shall be supplied by a concrete supplier that has been approved by the city. A list of approved concrete suppliers will be maintained by the City of Winnipeg, Research and Standards Engineer.

Unless otherwise specified in the Specifications for the Work, the use of a ready-mixed concrete plant only will be permitted. Concrete shall be proportioned, mixed and delivered in accordance with the requirements of CSA A23.1, Clause 18, Production of Concrete, except that the transporting of ready-mixed concrete in non-agitating equipment is not permitted without the written permission of the Contract Administrator.

The discharge of ready-mixed concrete from the transit mixer shall be completed within 1½ hours after the introduction of the mixing water to the cement and aggregates, unless the Contract Administrator authorizes an extension of time.

Transit mixers supplying concrete under this specification shall have a MRMCA certification sticker affixed to the rear window of the driver's cab. All delivery tickets shall indicate the time of batching.

8. EQUIPMENT

8.1 Ready Mixed Concrete Production Facilities

Commercial ready-mixed concrete plants and batch plants supplying Portland Cement Concrete under this Specification shall be certified in accordance with the Manitoba Ready Mix Concrete Association's "Certification of Ready Mixed Concrete Production Facilities". Proof of certification shall be submitted with the Mix Design Statement.

Batch plants must be equipped with batch weight recorders and the results made available to the Contract Administrator upon request.

8.2 Paving Equipment

The Contractor shall use a self-propelled slip form paver with a minimum gross weight of 25 000 kg driven by an engine having a minimum 150 kW to construct pavements with widths between 5.0 m and 8.0 m.

The Contractor shall use a self-propelled slip form paver with a minimum gross weight of 15 000 kg and driven by an engine having a minimum 100 kW, to construct pavements with widths less than 5.0 m.

If a slip form paving machine is used for concrete placement, it shall be of a size and type adequate to handle the width and thickness of the concrete pavement to be constructed. The slip form paver shall distribute the fresh concrete evenly to the required grade without segregation and without disturbing the 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 pavement and shall be of sufficient length that the concrete will not deform at the edges by the time the forms have passed. If a slip form paver is not being used, the paving equipment used for placing concrete shall have a

demonstrated ability to meet the specified tolerances for concrete pavement. The Contract Administrator shall reject any paving equipment should the paving equipment not field perform within the specified tolerances.

8.3 Paving Equipment Vibratory Devices

When called for by the Contract Specifications, the paving equipment vibratory devices shall be checked by the Contractor in the presence of the Contract Administrator, by use of a vibrating reed tachometer prior to commencement and during the paving operations.
Performance and checking of the vibrators shall conform to the paving equipment manufacturer's specifications.

8.4 Moveable Work Bridges

Where more than one lane is being paved at a time, two moveable work bridges independent of the paving machine shall be required, one for finishing and one for curing operations.

8.5 Bull Floats

Bull floats used for initial finishing of the in-place concrete pavement, shall be constructed of wood and shall be approved for use by the Contract Administrator prior to construction. The use of magnesium floats is not permitted.

9. CONSTRUCTION METHODS

9.1 Forms

Forms for concrete shall be constructed of steel or wood and shall be sufficiently rigid to prevent lateral or vertical distortion from the loading environment to which the forms will be subjected. All forms shall be set to the design grades, lines and radii as shown on the Drawings. Forms shall be adequately anchored and firmly set over bearing areas to prevent displacement during concrete placement. All formwork in place shall be subject to inspection and correction of grade and alignment prior to, and at any time during concrete placement.

The surfaces of all formwork to come in contact with the concrete shall be thoroughly cleaned and treated with form coating before concrete placement. The form coating shall be applied by brush or spray so as to give the forms an even coating without excess or drip, and shall not be allowed to get on any reinforcing steel. The form coating shall not cause a softening or permanent staining of the concrete surface and, further, it shall not impede the proper functioning of the curing compound.

Forms shall not be removed for a period of at least twenty-four (24) hours after the concrete placement has been completed. Removal of forms shall be done in a manner in order to avoid damage to, or spalling of, the concrete.

9.2 Placing Reinforcing Steel

9.2.1 Reinforced Concrete Pavement

All reinforcing steel shall be positioned as shown on the Drawings and shall be held in place by positive and satisfactory means so that the correct position of the reinforcing steel will be maintained after the concrete has been placed, vibrated and finished. If reinforcing steel is displaced during concrete placing operations, concrete placement shall cease and shall not resume until the displaced reinforcing steel has been reset to its true design position.

Field lap joints shall be securely wired or clipped. Splices, other than those shown on the Drawings or

approved by the Contract Administrator, will not be permitted. Splices shall have a length sufficient to develop the full strength in bond of the bar and shall be well distributed and only located in areas of low tensile stress. Reinforcing steel shall be securely fastened at all laps, intersections and splices.

Longitudinal steel bars which cross transverse joints shall be aligned parallel to the centreline and surface of the slab with a maximum allowable tolerance of $\pm$ 6 mm from the transverse joint to the end of the bar.

Once all reinforcing steel is in position, it shall be inspected and approved by the Contract Administrator before any concrete is placed. Otherwise the concrete will be rejected by the Contract Administrator and shall be removed by the Contractor at his own expense.

9.2.2 Plain-Dowelled Concrete Pavement

Dowels shall be located at all transverse contraction joints by means of an approved dowel assembly positioned as shown on the drawings. The methods for fastening the dowel assembly to the base shall be subject to the approval of the Contract Administrator. The dowels shall be aligned parallel to the centreline and surface of the slab with a maximum allowable tolerance of $\pm$ 12 mm. The dowel assemblies shall be fabricated sufficiently rigid so the dowels are held in alignment within the specified tolerance, both horizontally and vertically, until the concrete placing and setting cycle is complete.

For dowel assemblies with side members and ties, the dowels shall be securely fastened at alternate ends to the side members to prevent any movement of the dowels.

All dowels shall be thoroughly coated at the site with a thin uniform coating of MC-250 cut-back asphalt or approved equal bond breaker for the length of the dowel. The bond breaker coating shall be smooth and free of voids.

The position of the dowel assembly shall be clearly marked by the Contractor on the forms or by stakes so that the location of the transverse joint can be accurately located for joint construction.

Tie bars shall be positioned as shown on the Drawings. They shall be placed at mid-depth of the pavement and parallel to the pavement surface and the transverse joints. The use of 90^0 bent tie bars will not be allowed.

If dowels or tie bars are displaced during concrete placing operations, concrete placement shall cease and shall not resume until the displaced dowels or tie bars have been reset to the true design position.

Once dowels and tie bars are in position, they shall be inspected and approved by the Contract Administrator before any concrete is placed. Otherwise the concrete will be rejected by the Contract Administrator and shall be removed by the Contractor at his own expense.

9.2.3 Tying Into Existing Pavement

Where the Drawings call for a new slab to be tied into an existing slab along a longitudinal joint, the Supplier shall install tie bars into the existing slab. Tie bars in drilled holes shall be installed and paid for in accordance with Specification CW 3230.

Where the Drawings call for a new slab to be tied into an existing slab along a transverse joint, the Supplier shall install dowels into the existing slab. Dowels in drilled holes shall be installed and paid for in accordance with Specification CW 3230.

9.3 Joints

Contraction, longitudinal and construction joints shall be constructed, where required, in accordance with the details shown on the Drawings or as directed by the Contract Administrator. The joints shall be vertical and shall not deviate more than 15 mm from the horizontal alignment shown on the Drawings. All joints in pavement slabs shall be continuous through the curbs, median slabs, bull-noses, safety medians and boulevard or median splash strips.

Expansion joints shall be constructed only where new concrete is being placed up against existing non-pavement structures, where directed by the Contract Administrator. A 15 mm thick fibre joint filler shall be installed in expansion joints. The fibre joint filler shall extend from the base of the concrete slab up to the concrete surface, but no higher.

Where concrete is to be placed against an existing pavement structure, the joint shall be constructed as shown on the Drawings, or as directed by the Contract Administrator.

The Contractor shall obtain the Contract Administrator's approval on all placement of reinforcing steel in odd shaped installations to ensure proper alignment with saw-cut joints.

Contraction joints shall be saw-cut in succession by a single cut, 3 mm wide to the depths and alignments as shown on the Drawings, as soon as the concrete is sufficiently hard so that it will not be ravelled or damaged by the blade. The time at which all such saw-cutting is to be undertaken shall be determined by the Contractor.

When construction joints are to be sealed; the joint must be second cut to a width and depth as shown on the drawings.

Longitudinal joints shall be saw-cut as per contraction joints. When sawing longitudinal joints, the Contractor shall ensure that any residue cleaned from the longitudinal joint does not go into the previously cleaned contraction joints. For lane-at-a-time paving only, the longitudinal joint may be constructed by initially depressing an approved tool into the plastic concrete or by installing a filler strip which shall remain in place until the concrete has attained it's initial set and shall then be removed without disturbing adjacent concrete. The joint shall then be saw-cut to the width of 3 mm and depth *as* shown on the Drawings*.* The longitudinal joints shall be second cut and filled with joint sealer as shown on the drawings.

For late in season construction, second cut shall not be completed if ambient temperature is below 4^0C. Second cut shall be completed the next season when temperature requirements can be met.

9.4 Concrete Placement

No concrete shall be placed until the Contract Administrator has examined and approved the layout of the forms, reinforcing steel, dowels, tie bars and joints and the condition and grade of the compacted base course.

The placing of concrete on a base course which is too wet or too dry, or which is frozen, will not be permitted. The prepared grade shall be sufficiently moist to prevent absorption of water from the freshly placed concrete, but must be free from mire or water pondage. The temperature of the fresh concrete shall not be less than 10.0°C nor greater than 30.0°C, as measured at time of placing.

Concrete shall be deposited as nearly as practicable to its final position in a rapid and continuous operation in such a manner as to require as little rehandling as possible and to avoid segregation and separation of the materials.

The sequence of concrete placement shall be arranged so that no concrete, which has partially hardened, will be subjected to injurious vibration or shock.

Concrete shall be placed while fresh and before it has taken its initial set. Retempering of partially hardened concrete with additional water will not be permitted.

The deposited concrete shall be spread by means of a mechanical spreader or by an approved hand method. The surface of the concrete shall then be struck off by mechanical means in a manner such that when the concrete is vibrated and screeded the finished concrete will conform to the cross-section and elevation shown on the Drawings.

In areas inaccessible to mechanical equipment, after the concrete has been vibrated, the surface of the concrete shall be struck-off manually with appropriate tools and in an approved manner so that the concrete will conform to the cross-section and elevation shown on the Drawings. Neat cement or mortar shall not be used to facilitate the finishing surfaces.

Mechanical vibrators only shall be used to consolidate the concrete. Spading, hand tamping, using puddling rods, or using other similar methods will not be permitted in place of vibration.

Vibration shall be applied at the point of deposit and in areas of freshly deposited concrete. Vibrators shall be inserted vertically into and withdrawn vertically out of the concrete slowly. Vibrations shall be of sufficient duration and intensity to thoroughly consolidate the concrete, but shall not be continued so as to cause segregation. Vibrators shall not be used for flowing the concrete or spreading it into place.

Concrete shall be worked thoroughly around any reinforcement, dowels, tie bars and around embedded fixtures and into the angles and corners of the forms. During placement, concrete shall be sufficiently vibrated with suitable equipment to ensure a secure bond with the reinforcement, dowels and tie bars, to eliminate entrapped air voids, and to ensure a homogeneous structure and adequate consolidation. Particular care shall be given to placing and vibrating the concrete along the faces of the forms to ensure a dense, smooth surface devoid of imperfections.

No persons shall be permitted to walk in the screeded concrete. Any remedial work shall be done from the sides of the concrete pour or from work bridges.

Once the placing and vibrating of the concrete has been completed, the forms shall not be jarred, and any projecting reinforcing steel shall not be disturbed, for a period of at least twenty-four (24) hours. At the end of a slip form paving pour, concrete shall be sawcut full-depth and removed. There shall be no measurement or pavement for the saw cutting, removal or concrete lost.

Bonding grout shall be applied to the surface of the slab immediately prior to placement of plastic concrete for separate curb. Use compressed air that has an oil free air jet having sufficient volume and pressure to remove dust and loose particles immediately prior to applying bonding grout. Apply in a thin, even coating so that the bonding grout does not run or puddle.

Bonding grout shall be applied where the concrete pavement will not be overlayed with asphalt.

9.5 Concrete Finishing

Finishing shall be regulated in order that quality of the surface is not impaired by overworking or by bringing excessive fines and water to the surface. The use of steel trowels is not permitted.

Prior to final finishing, the surface grade of concrete slabs shall be checked to an accuracy of plus or minus 5 mm, with a rounded shape 3.0 metre long metal straight edge, unless otherwise specified in the Specifications for the Work. The straight edge shall be drawn across the pavement in a scraping motion to identify deviations for immediate correction. The straight edge shall be advanced one-half of its length for successive checks.

Where placement of the concrete pavement is facilitated by use of a slip form paving machine, additional floating of the surface by hand methods shall only be done if required to correct surface

imperfections identified by checking with the 3.0 metre long metal straight edge, or as directed by the Contract Administrator.

When drying conditions are greater than or equal to 0.75 kg/m^2/hr as estimated by use of Figure D1, Appendix D, Guidelines for Curing and Protection, of CSA A23.1, the plastic concrete surface shall be protected from drying by application of an evaporation retardant according to clause 5.4.10. The evaporation retardant shall be applied immediately after checking the surface with the 3.0 m long metal straight edge and shall be reapplied between finishing operations.
Following completion of floating operations, but prior to initial set of the concrete, the edges of all formed concrete slabs shall be carefully finished with an appropriate edging tool.

Upon completion of finishing operations, and when excessive moisture has evaporated, the plastic surface of the entire pavement shall be given a textured finish by means of broom finishing with a steel or fibre broom of a type approved by the Contract Administrator at right angles to the direction of traffic. Surface depressions introduced by the broom strands in the brooming operations shall not be more than 3 mm deep. Broom finishing will similarly be required for surfaces of private approaches, gutters, bull-nose slabs, boulevard and median slabs, and other related slabs. Broom finishing will not be required when the concrete does not form the finished surface.

When specified by the Contract Administrator, for pavements with high design speeds, the concrete surface shall be given a transverse tine texture. The finish shall be constructed by using a single transverse pass of an artificial turf or burlap followed by a transverse tine texturing device. The device shall consist of a single line of flat, slightly flexible, tempered steel tines, spaced 15 mm apart. The tine width shall be 3.2 mm. Texturing is to be applied while the concrete is still plastic enough to obtain a depth of at least 3.2 mm but not more than 6.4 mm. The tine texture shall be obtained by one continuous pass of the device for the full width of pavement being textured.

Where indicated in the Contract Specifications, the finished surface of the hardened concrete slabs shall be measured for roughness by the Contract Administrator. The roughness data will be reduced to an International Roughness Index, IRI. An acceptable IRI will be less than or equal to two (2), based on test sections approximately 100 metres long, measured along the wheel paths. No tests will be performed across designed grade breaks. Random testing by the City will be completed within 18 hours after the pavement has been placed. The Supplier will be informed of test results within 48 hours after the pavement has been placed. Sections of pavement that fail in roughness shall be corrected at the Contractor's expense to produce an acceptable IRI.

9.6 Concrete Curing

Immediately following concrete finishing and after excess moisture due to bleeding has evaporated. The surface of the concrete shall be completely treated with a white-pigmented water based liquid membrane-forming curing compound, in accordance with the manufacturer's recommendations. The minimum rate of application shall not be less than that recommended by the manufacturer. As soon as the side forms are stripped, the edges of all concrete slabs shall be completely sprayed white. In the case of slip form paving, the edges shall be completely sprayed white at the same time as the pavement surface.

After application, the white-pigmented liquid membrane-forming curing compound shall be protected as per the manufacturer's recommendations from rain or snow.

Curing compound shall not be used when the pavement is otherwise protected from cold weather by polyethylene film for a period of not less than five days.

9.7 Joint Sealing

The joints shall be thoroughly cleaned of all dirt, loose mortar particles and other foreign material lodged in the joints.

Joints and the pavement surface shall be cleaned of all residue left by the sawing operation. Initial cleaning shall be done by water jet having sufficient volume and pressure to remove the residue. Alternative methods of cleaning joints, must be approved by the Contract Administrator. The joint shall be blown out with an air jet having sufficient volume and pressure to remove the residue. Joints shall be allowed sufficient time to thoroughly dry before the application of the joint sealer.

Install backer rods immediately after cleaning and before sealant installation. Backer rods shall be inserted uniformly to the required depth to achieve the required shape factor. Backer rods shall be inserted using a double wheel steel roller and shall not be punctured or stretched during the installation process.

The joint shall then be filled with low modulus joint sealer to the depth shown on the Drawings using an approved mechanical pressure joint filling system. Overfilling of joints shall not be permitted. Overfilled joints shall have excess material removed to the satisfaction of the Contract Administrator. The joint must be surface dry at the time of filling, and the ambient temperature must be at least 4°C and rising.

Where Neoprene seals are used, Neoprene seals are to be installed in transverse concrete pavement joints only. All longitudinal joints are to be sealed in accordance with CW 3310. The seals are to be installed in accordance with the manufacturer's specifications. The seals shall be installed on the basis of a maximum joint spacing of 5000 mm. The joints shall be constructed in accordance with Standard Detail SD-212 for sawn joints, except that the reservoir cut shall be a minimum of 38 mm in depth.

9.8 Weather Conditions

The Contractor shall be responsible for taking all necessary measures to protect freshly laid concrete from adverse weather conditions, including hot weather, wind, rain, sleet, snow and cold weather, to the satisfaction of the Contract Administrator.

Concrete shall be adequately protected from freezing for a minimum of five (5) days after completion of placing operations, or longer as required to ensure that the pavement opening requirements of Clause 9.9 of this Specification are met. A minimum requirement for protection shall be provided as follows when the air temperature as forecast by Environment Canada is:

0°C to -3°C The concrete shall be covered with polyethylene film.

-3°C to -5°C Insulated tarp(s) or two sheets of polyethylene film covering, separated by 300 mm of dry straw.

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

When air temperature is at or will be above 27°C during the basic curing period, curing shall be accomplished in accordance with the requirements of CSA A23.1.

9.9 Opening to Traffic

In no case shall traffic or construction equipment be allowed on the pavement until the concrete has reached a minimum compressive strength of 20 MPa, as determined by additional field cured cylinders.

If an early opening requirement is included in the Contract, a compressive strength of 20 MPa shall be attained within the specified opening time.

The Contract Administrator's decision as to when the pavement will be opened to traffic shall be final. Prior to opening to traffic, the pavement shall be swept clean.

9.10 Temporary Restoration of Utility Pavement Cuts

Prior to the placement of concrete for temporary restoration of utility pavement cuts, stabilized fill material shall be placed to within 150 mm (minimum) to 250 mm (maximum) of the top of the existing pavement surface in accordance with CW2160.
Upon acceptance of the placed stabilized fill by the Contract Administrator, the contractor shall place concrete supplied in accordance with the requirements of Clause 6.6 of this specification.

All snow, ice and loose concrete or asphalt along the edges shall be removed before placement of concrete.

The concrete shall be placed by hand methods and finished to match the existing pavement surface.

When air temperatures at time of concrete placement are less than 0°C, the concrete shall be covered with insulated tarps for a minimum of 24 hours prior to opening to traffic.

10. QUALITY ASSURANCE

10.1 Testing Frequency

The Contract Administrator shall ensure the number and frequency of quality assurance tests as follows:

One concrete test shall consist of:
Slump test
Air test
One lab cure cylinder – 7 day break
Two lab cure cylinders – 28 day break

Slip Form or Hand Pour:

<100 cu.m. per day – The minimum testing frequency per day for each mix design shall be one test on the first truck, then one test every 30 cu.m. or part thereof.

> 100 cu.m. per day - The minimum testing frequency per day for each mix design, shall be one test on the first truck, then one test every 100 cu.m. or part thereof.

If any air or slump test fails for any concrete load in the day's pour, continue to test slump and air on succeeding trucks until consistency is established.

Additional testing shall be as directed by the Contract Administrator. To establish the field strength for early opening of pavement, take additional field cure cylinders with a break time to match the concrete mix.

Copies of all test results shall be sent to the Research and Standards Engineer for the Public Works Department and to the Contract Administrator.

Copies of Plant Batch tickets shall be sent to the Research and Standards Engineer for the Public Works Department upon request by the Research and Standards Engineer.

10.2 Concrete Quality

Slump tests shall be made in accordance with CSA A23.2-5C, Slump of Concrete. If the measured slump falls outside the limits specified in Clause 6 of this Specification, a second test shall be made.

In the event of a second failure, the Contract Administrator reserves the right to refuse the use of the batch of concrete represented.

Air content determinations shall be made in accordance with CSA A23.2-4C, Air Content of Plastic Concrete by the Pressure Method. If the measured air content falls outside the specified limits, a second test shall be made at any time within the specified discharge time limit for the mix. In the event of a second failure, the Contract Administrator reserves the right to reject the batch of concrete represented.

Samples of concrete for all slump, air, and strength tests shall be taken in accordance with CSA A23.2-1C, Sampling Plastic Concrete.

Test specimens shall be made and cured in accordance with CSA A23.2-3C, Making and Curing Concrete Compression and Flexure Test Specimens.

Compressive strength tests of concrete cylinders shall be conducted in accordance with CSA A23.2-9C. Compressive Strength of Cylindrical Concrete Specimens.

Compressive strength tests on specimens cured under the same conditions as the concrete works shall be made to check the strength of the concrete so as to determine if the pavement may be opened to traffic, and also to check the adequacy of curing and/or cold weather protection.

Where compressive strengths do not meet the specifications, the City shall require actions be taken in accordance with CSA A23.1. Cost of additional testing including core removal, core testing and repair of core holes shall be paid for by the contractor.

Where scaling of the concrete surface occurs during the Warranty Period, as determined by the Contract Administrator, the Contractor shall solely, at his expense, retexture the scaled areas by mechanical means acceptable to the Contract Administrator or replace the full thickness of pavement for those areas.

10.2 Concrete Pavement Roughness

As a basis for acceptance, the surface of the finished concrete pavement shall be checked with a 3 metre long metal straight edge and be within plus or minus 5 mm. Areas of pavement that do not meet these tolerances shall be corrected to the satisfaction of the Contract Administrator.

10.3 Addition of Water and/or Air Entraining Admixture

After initial mixing no water and/or air entraining admixture may be added except if, at the start of discharge the measured slump of the concrete or the measured air content of the concrete is less than that specified and no more than 60 minutes have elapsed from the time of batching to the start of discharge. Water added shall not exceed 12 litres per cubic metre as measured by an approved measuring device.

Air entraining admixture shall be added as required to meet specified allowable air content ranges. The mixer drum shall be turned a minimum of 30 revolutions at mixing speed and the slump and air content shall be retested.

10.4 Acceptance Criteria

Acceptance criteria for compressive strengths of laboratory cured cylinders shall conform to CSA A23.1.

12. METHOD OF MEASUREMENT

12.1 Concrete Pavements, Median Slabs, Bull-noses and Safety Medians

Construction of concrete pavements, median slabs, bull-noses and safety medians will be measured on a surface area basis. The surface area to be paid for shall be the total number of square metres constructed in accordance with this Specification and accepted by the Contract Administrator, as computed from measurements made by the Contract Administrator.

12.2 Concrete Pavements for Early Opening

Construction of concrete pavements for early opening will be measured on a surface area basis. The surface area to be paid for shall be the total number of square metres constructed in accordance with this Specification and accepted by the Contract Administrator, as computed from measurements made by the Contract Administrator.

12.3 Concrete Curbs, Curb and Gutter, and Splash Strips

Construction of concrete curbs, curb and gutter, and splash strips will be measured on a linear measure basis. The length to be paid for shall be the total number of metres constructed in accordance with this Specification and accepted by the Contract Administrator, as computed from measurements made by the Contract Administrator.

12.4 Dowel Assemblies

Supply and installation of dowel assemblies, including epoxy-coated dowels, will be measured on a linear measure basis. The length to be paid for shall be the total number of metres of transverse joints in which the dowel assemblies are supplied and installed in accordance with this Specification and accepted by the Contract Administrator, as computed from measurements made by the Contract Administrator.

12.5 Tie Bars

Supply and installation of tie bars, except for drilled tie bars, shall be incidental to the construction of Portland cement concrete pavements.

13. BASIS OF PAYMENT

13.1 Concrete Pavements, Median Slabs, Bull-noses and Safety Median

Construction of concrete pavements, median slabs, bull-noses and safety median will be paid for at the Contract Unit Price per square metre for the "Items of Work" listed here below, measured as specified herein, which price shall be payment in full for supplying all materials and performing all operations herein described and all other items incidental to the work included in this Specification. The unit price shall be reduced for deficiencies in pavement thickness as per Clause 13.3 of this Specification.

Items of Work:

i. "Construction of 250 mm Concrete Pavement (**)(***)"
ii. "Construction of 230 mm Concrete Pavement (**)(***)"
iii. "Construction of 200 mm Concrete Pavement (**)(***)"
iv. "Construction of 150 mm Concrete Pavement (**)(***)"
v. "Construction of Concrete Median Slabs (*)"
vi. "Construction of Monolithic Concrete Median Slabs (*)"
vii. "Construction of Concrete Safety Medians (*)"
viii. "Construction of Monolithic Curb and Sidewalk (*)"
ix. "Construction of Monolithic Concrete Bull-noses"

* Specify referenced Standard Detail
** Specify either Reinforced or Plain-Dowelled
*** Specify Slip Form Paving if required.

13.2 Concrete Pavements for Early Opening

Construction of concrete pavements for early opening will be paid for at the Contract Unit Price per square metre for the "Items of Work" listed here below, measured as specified herein, which price shall be payment in full for supplying all materials and performing all operations herein described and all other items incidental to the work included in this Specification. The unit price shall be reduced for deficiencies in pavement thickness as per Clause 13.3 of this Specification.

Items of Work:

i. "Construction of 250 mm Concrete Pavement for Early Opening (*)(**)(***)"
ii. "Construction of 230 mm Concrete Pavement for Early Opening (*)(**)(***)"
iii. "Construction of 200 mm Concrete Pavement for Early Opening (*)(**)(***)"
iv. "Construction of 150 mm Concrete Pavement for Early Opening (*)(**)(***)"

* Specify either 24 hour or 72 hour
** Specify either Reinforced or Plain-Dowelled
*** Specify Slip Form Paving if required.

13.3 Pavement Thickness Tolerances

At the option of the Contract Administrator, pavement thickness may be determined by coring pavement sections representing each day's pour and determining the pavement thickness by averaging the depth of the cores.

Pavement found deficient in thickness by more than five (5%) percent shall be paid for at the reduced price. The reduced price = P_R x contract price;

P_R is in % and T_D is in %

Where: $P_R = 100 - [(T_D - 5) / 5]$ x 25
Where: T_D = thickness deficiency greater than or equal to 5%, up to 10%.

When the pavement thickness is deficient by more than ten (10%) percent and the judgement of the Contract Administrator is that the area of such deficiency should not be removed and replaced, payment will be fifty (50%) percent of Contract Unit Price.

The cost of initial cores will not be paid for by the Contractor. Additional cores requested by the Contractor to determine the extent of areas deficient in thickness, shall be paid for by the Contractor.

13.4 Concrete Curbs, Curb and Gutter, and Splash Strips

.1 Construction of concrete curbs, curb and gutter, and splash strips will be paid for at the Contract Unit Price per metre for the "Items of Work" listed here below, measured as specified herein, which price shall be payment in full for supplying all materials and performing all operations herein described and all other items incidental to the work included in this Specification.

Items of Work:

i. "Construction of Barrier Curb (*)"
ii. “Construction of Modified Barrier Curb (*)”
iii. “Construction of Curb and Gutter (*)”
iv. “Construction of Mountable Curb (*)”
v. “Construction of Lip Curb (*)”
vi. “Construction of Curb Ramp (*)”
vii. “Construction of Safety Curb (*)”
viii. “Construction of Splash Strips (**)”

* Specify height, type and Referenced Standard Detail
**Specify height, monolithic or separate, type, width, and referenced Standard Detail

.2 No measurement or payment shall be made for supply or placement of bonding grout for concrete curbs.

.3 Drilled curb ramp tie bars are to be paid in accordance with CW 3230.

13.5 Dowel Assemblies

Supply and installation of dowel assemblies will be paid for at the Contract unit Price per metre for "Supply and Installation of Dowel Assemblies", measured as specified herein, which price shall be payment in full for supplying all materials and performing all operations herein described and all other items incidental to the work included in this Specification.

13.6 Drilled Tie Bars and Dowels

Supply and installation shall be in accordance with 9.2.3 of this Specification.

Winnipeg **PUBLIC WORKS DEPARTMENT • SERVICE DES TRAVAUX PUBLICS** **Engineering Division • Division de l'ingénierie**	**Effective Date: February 1st, 2022** **DIVISION 4**
CW 3510 – R10	**SODDING**

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1. DESCRIPTION

1.1 General

1.1.1 This Specification shall cover the supply and placing of cultivated turfgrass sod in park areas and in boulevard and median areas adjacent to the pavement.

1.2 Referenced Standard Construction Specifications

1.2.1 CW 3110 – Sub-Grade, Sub-Base and Base Course Construction

1.2.2 CW 3540 – Topsoil and Finish Grading for Establishment of Turf Areas

2. MATERIALS

2.1 General

2.1.1 The Contractor shall be responsible for the supply, safe storage and handling of all materials set forth in this Specification. All sod supplied under this Specification shall be subject to inspection and testing by the Contract Administrator and/or the City's Parks Area Superintendent. There shall be no charge to the City for any materials taken by the Contract Administrator or the City's Parks Area Superintendent for inspection purposes.

2.1.2 Sod will be subject to tests for nitrate, phosphate, potassium, sulphate, pH, E.C. (salinity), mineral soil layer thickness and its organic matter content by a testing laboratory designated by the Contract Administrator.

2.1.3 Tests conducted to determine the thickness of the mineral soil layer of the sod and its percent of organic matter shall be done in accordance with standard operating procedures approved by the Contract Administrator for both receiving, and analysing sod samples.

2.1.4 Any sod placed on the Work Site that in the opinion of the Contract Administrator does not conform to the Specification detailed herein, shall be rejected by the Contract Administrator and replaced by and at the expense of the Contractor.

2.2 Topsoil

2.2.1 Topsoil shall be supplied in accordance with Clause 5.2 of CW 3540.

2.3 Turf Grass Sod

2.3.1 The Contractor shall supply turf grass sod with a mineral soil layer containing a minimum of seventy (70%) percent inorganic soil. Upon delivery or thirty (30) days following delivery, the salinity rating shall be less than 4.0 mm hos/cm on a saturated paste basis. The pH range shall be between 6.0 – 8.0. Sod supplied shall have been sown in nursery fields with Canada Certified No. 1 or Canada Certified No. 2 grass seed and mixed by percentage (%) of weight to meet the following certified seed blends or mixtures:

2.3.1.1 Athletic grounds and golf course fairways, sod shall contain a blend composed of:

2.3.1.1.1 One hundred (100%) percent Kentucky Bluegrass (100% Class 1 cultivars as specified in Clause 2.3.1.3, 3 cultivars in equal proportion).

2.3.1.2 For general park areas, boulevards, medians and interchange areas, sod shall contain:

2.3.1.2.1 A blend composed of one hundred (100%) percent Kentucky Bluegrass (100% Class 1or Class 2 cultivars as specified in Clause 2.3.1.3, 3 cultivars in equal proportion); or

2.3.1.2.2 A mixture of ninety-five (95%) percent Kentucky Bluegrass (100% Class 2 cultivars as specified in Clause 2.3.1.3, 3 cultivars in equal proportion) and five (5%) percent Creeping Red fescue.

2.3.1.3 Wherever Kentucky Bluegrass is specified, the proportion of the cultivars to be included in the blend shall adhere to the following:

Class 1 Cultivars – specified blend of Class 1 cultivars shall consist of equal proportions of any three of the following:

Able 1	Absolute	Allure	Award	Baron
Bartitia	Blacksburg	Blackstone	Caliber	Challenger
Chateau	Estate	Explorer	Kelly	Liberator
Limousine	Midnight	Misty	Northstar	NuGlade
Pick 151	Pick 8	Platini	Quantum Leap	Rambo
Rugby II	Serene	Shamrock	SR 2000	Total Eclipse
Touchdown	Unique	VB 16015	Wildwood	

Class 2 Cultivars – specified blend of Class 2 cultivars shall consist of equal proportions of any three of the following:

A34	Abbey	Alpine	America	Apollo
Arcadia	Ascot	ASP 200	Banff	Baronie
Baruzo	Bluechip	Cardiff	Champagne	Chicago
Classic	Compact	Conni	Coventry	Crest
Cynthia	Dragon	Eclipse	Fortuna	Glade
Goldrush	Haga	Huntsville	Impact	Indigo
Jefferson	Kenblue	Langara	Lipoa	Livingston
Marquis	Mercury	Moonlight	Nimbus	NuBlue
NuStar	Odyssey	Park	Pepaya	Pick 3
Pick 4	Pick 855	Princeton 105	Raven	Rugby
Seabring	Sodnet	SR 2100	SR 2109	Washington

2.3.1.4 Any variations to the above referenced seed blends or mixtures shall be approved by the Contract Administrator prior to placement of sod.

2.3.1.5 Turf grass sod shall be free of disease, turf damaging insects and any grass

specifies, strains or cultivars other than specified herein.

2.3.1.6 At the time of delivery, the turf grass sod shall:

2.3.1.6.1 Not contain more than ten (10) broadleaf weeds per fifty (50) square metres;

2.3.1.6.2 Have been mowed to a height of 50 mm prior to delivery and be of sufficient density that no surface soil will be visible;

2.3.1.6.3 Have a uniform inorganic soil layer thickness of not less than 12 mm and not greater than 19 mm and shall be consistent throughout all loads delivered to the work site;

2.3.1.6.4 Have the organic thatch layer within the sod not exceed an uncompressed thickness of 12 mm and in all cases, the final rolled and compacted topsoil/sod growing medium shall be maintained at not less than 100 mm in depth.

2.4 Herbicides

2.4.1 Herbicides shall be standard commercial products registered for sale and use in Canada under the Pest Control Products Act.

2.5 Insecticides

2.5.1 Insecticides shall be standard commercial products registered for sale and use in Canada under the Pest Control Product Act.

3. CONSTRUCTION METHODS

3.1 Site Safety and Traffic Control

3.1.1 Where work is to be done in boulevard and median areas adjacent to roadways, the Contractor shall maintain traffic and ensure that protection is afforded to the road user and that the Contractor's operations in no way interfere with the safe operation of traffic.

3.1.2 The Contractor shall supply, erect and maintain all applicable traffic control devices in accordance with the provisions of the latest edition of the Manual of Temporary Traffic Control in Work Areas on City Streets issued by the Public Works Department of the City of Winnipeg.

3.2 Site Grading

3.2.1 Site grading will be done and paid for in accordance with Specification CW 3110.

3.3 General

3.3.1 The Contractor shall not commence sodding operations until the finished topsoil surface has been inspected and approved by the Contract Administrator.

3.3.2 The Contractor shall provide the Contract Administrator with a minimum of two working days notice for inspection of the finished topsoil surface.

3.4 Topsoil and Finish Grading

3.4.1 Preparation of the finished topsoil surface shall be completed in accordance with Specification CW 3540.

3.4.2 To prevent the formation of depressions or water pockets, the Contractor shall smooth out any undulations or irregularities in the topsoil surface prior to placing the sod.

3.5 Placement of Sod

3.5.1 The sod shall be placed evenly and closely packed together, leaving no open joints and no overlap on adjacent pieces of sod. Joints in adjacent rows shall be staggered, as shown in Standard Detail SD-243. A full row of sod, not less than 450 mm in width shall be placed along the perimeter of the sodded area, parallel to planting or walkway areas.

3.5.2 Where big roll sod is to be placed, the Contractor shall ensure that any reinforcement netting that may be used to assist with the harvesting and/or placement of the sod roll is removed before final placement of the sod.

3.5.3 On embankments, sod shall be placed lengthwise across the face of the slope. On slopes of 1 vertical to 3 horizontal (18 degrees) or steeper, in every second row on the slope and at the foot of the slope, each piece of sod shall be pegged with two minimum 250 mm long wooden pegs driven into the soil layer of the sod.

3.5.4 For slopes of 1 vertical to 2 horizontal (26 degrees) or steeper, each piece of sod in every row shall be pegged as indicated above.

3.5.5 When abutting an existing turfed area, cut the existing turf so as to form a straight joint with the new sodded area.

3.5.6 Small, broken or irregular pieces of sod will be rejected.

3.5.7 All visible joints, low, bare or dead spots shall be repaired to the satisfaction of the Contract Administrator prior to the commencement of the Thirty (30) Day Maintenance Period described in Clause 3.7.

3.5.8 Sodding operations shall be completed within two working days after placing the sod. This shall be deemed to include watering, rolling, and repairing any visible joints and low, bare or dead spots within the sodded area.

3.5.9 Sod shall not be placed in a frozen state, or when any other conditions unfavourable to the successful transplanting of sod exist.

3.5.10 The Contractor shall not place sod after September 15 unless the Contract Administrator gives written approval to proceed.

3.5.11 Should the Contract Administrator provide written approval to, or direct the Contractor to

place sod after September 15, and termination of the sod maintenance period is not achieved in accordance with Clause 3.10 in that same year, the Contractor will not be held responsible for sod damage over the winter due to winter-kill, ice damage, sand/salt applications on adjacent streets or from snow removal or spring clean up equipment. When the Contract Administrator provides written approval, or direction to the Contractor to place the sod after September 15, the City will assume all costs related to the spring replacement of sod damaged over the winter provided that the layover was due only to the late season start and not defective sod or maintenance not conforming to this Specification.

3.5.12 Where the Contractor places sod prior to September 15, and termination of the sod maintenance period is not achieved in accordance with Clause 3.10 in that same year, the Contractor shall be responsible for replacement of any sod damaged over the winter due to winter-kill, ice damage, sand/salt applications on adjacent streets, or from snow removal or spring clean up equipment.

3.6 Watering and Rolling

3.6.1 Immediately after placement of sod, the Contractor shall water the area in sufficient quantities and frequencies required to obtain root development and sod growth. All costs to provide water for sodded areas shall be borne by the Contractor. These costs may include hydrant permit and meter rental fees.

3.6.2 After the sod and topsoil has dried sufficiently to prevent damage, the areas shall be rolled (the edges pounded if necessary) with a mechanical roller minimum weight of 220kg and minimum width of 760mm to form a uniform even surface and level with adjoining existing grades, sidewalks and curbs. Heavy rolling to correct irregularities in grade will not be permitted. Sodded areas near existing fixtures that are unable to be rolled shall be thoroughly tamped to ensure a good bond between topsoil and sod.

3.7 Commencement of Thirty (30) Day Maintenance Period

3.7.1 Immediately after the sod has been placed to the satisfaction of the Contract Administrator, the Contractor shall provide and pay for continuous maintenance of the sodded area until the criteria specified for termination of the maintenance period in Clause 3.10 has been met.

3.7.2 The Contract Administrator will not allow the Thirty (30) Day Maintenance Period to commence until the following requirements are met:

3.7.2.1 Written approval has been granted by the Contract Administrator to place sod if after September 15.

3.7.2.2 The nursery sod supplied meets the seed mixture requirement specified in Clause 2.3.

3.7.2.3 The sod is free of bare and dead spots.

3.7.2.4 The nursery sod does not contain more than 10 broadleaf weeds per 50 square metres.

3.7.2.5 Sodded area has been rolled to form a firm, uniform even surface.

3.7.2.6 The sod has sufficient shoot density that no surface soil is visible within sod.

3.7.2.7 The height of the top growth of the sod is between 50 – 60 mm.

3.7.2.8 The sodded area is free of any visual obstructions such as leaves

3.7.2.9 Sodded area is free of any turf damaging insects.

3.7.3 Any deficient, damaged or vandalized areas shall be resodded by the Contractor within three working days after receiving notification from the Contract Administrator and the area so resodded, shall be further maintained until it meets the criteria specified in Clause 3.10.

3.7.4 In situations where the start of the Thirty (30) Day Maintenance Period is not granted by the Contract Administrator before the end of a growing season, the Thirty (30) Day Maintenance Period will commence on May 15 of the following year or such date as is mutually agreed upon by all parties, at which time all sodded areas must meet the requirements listed above.

3.8 Maintenance of Sodded Area

3.8.1 The Contractor shall mow the turf area at regular intervals to a height of between 50 - 60 mm. Do not cut more than thirty (30%) percent of the grass height at any one mowing. Remove clippings that will smother grassed areas.

3.8.2 The Contractor shall water sodded areas in sufficient quantities and frequencies required to maintain sod growth. All costs to provide water for sodded areas shall be borne by the Contractor. These costs may include hydrant permit and meter rental fees.

3.8.3 The Contractor shall provide adequate protection of sodded areas from erosion, pedestrian and mechanical damage, and shall only remove such protection after the sodded area has been accepted by the City's Parks Area Superintendent or designate.

3.8.4 The Contractor shall clean and remove all dead vegetation, leaves, debris and snowmold from turf areas to encourage healthy and uniform grass growth.

3.8.5 Given the need for weed control, the Contractor shall have in his possession a Pesticide Applicator's License and a Pesticide Use Permit for pesticide applications related to this Specification.

3.8.6 The Contractor shall apply herbicide when broadleaf weeds start developing in competition with grass. Apply herbicide in accordance with the City of Winnipeg Weed Control Standards and Procedures, manufacturer's instructions and the Manitoba Agriculture Guide to Crop Protection and Herbicide Recommendations for Landscape Applicators, latest editions and the following criteria:

3.8.6.1 Use 2,4-D Amine or MCPA Amine herbicide for susceptible broadleaf weeds.

3.8.6.2 Use a mixture containing 2,4-D Amine or MCPA Amine, Mecoprop and Dicamba for 2,4-D resistant plants.

3.8.6.3 Do not apply to newly seeded turf until after the second or third mowing.

3.8.6.4 Do not water within 24 hours after application.

3.8.6.5 Apply when winds are less than 20 km/h and air temperature is above 10° (degrees) Celsius.

3.8.6.6 Avoid use of pure Dicamba solutions near trees and shrubs.

3.8.7 Given the need for insect control, the Contractor shall have in his possession a Pesticide Applicator's License and a Pesticide Use Permit for pesticide applications related to this Specification. Use standard commercial products in accordance with the manufacturer's instructions and the Manitoba Agriculture Guide to Crop Protection (latest edition) for the particular insect/insects involved.

3.8.8 Copies of the Pesticide Applicator's License and the Pesticide Use Permit must be submitted to the Contract Administrator prior to commencement of pesticide application.

3.8.9 All persons handling pesticides shall be fully aware of toxicological rules and regulations governing their use.

3.8.10 The Contractor shall inform the Contract Administrator immediately of any dangerous occurrence.

3.9 Spring Clean Up

3.9.1 Where termination of the sod maintenance period has not been achieved in accordance with Clause 3.10 prior to the end of a growing season, the Contractor shall complete all operations related to the clean up of the work area in the following spring. This shall include the cleaning and removal of all dead vegetation, leaves, debris, snowmold and any sand or gravel resulting from winter sanding/deicing operations from turf areas to encourage healthy and uniform grass growth.

3.9.2 All costs for spring clean up operations shall be borne by the Contractor if in the previous year, the termination of the sod maintenance period, in accordance with Clause 3.10 was not achieved in that same year or where the damage was due to defective sod or maintenance not conforming to this Specification.

3.10 Termination of Maintenance Period

3.10.1 The Contract Administrator will terminate the sod maintenance period after the following criteria has been met:

3.10.1.1 The work site is clean and the sodded area is free of any visual obstructions such as leaves

3.10.1.2 The sod is free of bare and dead spots and without more than 10 broadleaf weeds per 50 square metres Do not apply to newly seeded turf until after the second or third mowing.

3.10.1.3 Grass roots are well anchored into the underlying topsoil and the sodded area has established into a healthy, vigorously growing condition.

3.10.1.4 Sodded areas are free of visible joints.

3.10.1.5 The sod has sufficient shoot density that no surface soil is visible when the grass has been cut to a height of 50 – 60 mm.

3.10.1.6 Sodded area has been cut to a height of 50 – 60 mm within two working days before the final inspection.

3.10.1.7 Sodded area is free of any turf damaging insects.

3.10.2 If the sodded area does not meet the above criteria, the deficient area shall be resodded within three working days after receiving notifications from the Contract Administrator and maintained by and at the expense of the Contractor in accordance with Clauses 3.7 and 3.8 herein.

3.10.3 In situations where the termination of the maintenance period is not granted by the Contract Administrator before the end of a growing season, the maintenance period will commence as described in Clause 3.7

3.11 Site Clean Up

3.11.1 During both the placement and maintenance of sod, all sidewalks, streets, approaches, driveways and properties near the sodding operation shall be kept clean at all times by the Contractor.

3.11.2 Upon completion of the project, the Contractor shall immediately remove all excess material, debris and equipment from the work site.

4. METHOD OF MEASUREMENT

4.1 Sodding

4.1.1 Supply, placement and maintenance of sod will be measured on an area basis. The area to be paid for shall be the total number of square metres placed and maintained in accordance with this Specification and accepted by the City's Parks Area Superintendent or designate, as computed from measurements made by the Contract Administrator. No payment will be made for sod placed outside of the limits of placement as directed by the Contract Administrator.

5. BASIS OF PAYMENT

5.1 Sodding

5.1.1 Supply, placement and maintenance of sod will be paid for at the Contract Unit Price per square metre for the "Items of Work" listed here below, measured as specified herein, which price shall be payment in full for supplying all materials and for completing all operations herein described and all other items incidental to the work included in this Specification. Payment for sodding shall be in accordance with the following:

5.1.1.1 Seventy-Five (75%) of quantity following supply and placement.

5.1.1.2 Remaining twenty-five (25%) percent of quantity following termination of the maintenance period.

Items of Work:

Sodding
- i.) Width < 600 mm
- ii.) Width ≥ 600 mm

CW 3520 – SEEDING

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CW 3520 - SEEDING

1. GENERAL CONDITIONS

The General Conditions and Standard Provisions attached hereto shall apply to and be a part of this Specification.

3. DESCRIPTION

This Specification shall cover the supply and placement of grass seed for athletic grounds, golf course fairways, general park areas, boulevards, medians and interchange areas.

The work to be done by the Contractor under this Specification shall include the supply of all materials, and the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies and all other things necessary for and incidental to the satisfactory performance and completion of all work as hereinafter specified.

5. MATERIALS

5.1 General

The Contractor shall be responsible for the supply, safe storage and handling of all materials set forth in this Specification. All materials supplied under this Specification shall be subject to inspection and testing by the Contract Administrator and/or the City's designated turf inspector. There shall be no charge to the City for any materials taken by the Contract Administrator or the City's designated turf inspector for inspection purposes.

5.2 Topsoil

Topsoil shall be supplied in accordance with Clause 5.2 of CW 3540.

5.3 Grass Seed

All seed supplied by the Contractor shall be Canada Certified No. 1 or Canada Certified No. 2 and come complete with a Certificate of Analysis verifying that quality standards for Canada Certified No. 1 or Canada Certified No. 2 seed are met. The Contractor shall submit the Certificates of Analysis to the Contract Administrator.

The seed supplied shall be free of disease and mixed by percentage (%) of weight to meet the following blends or mixtures:

5.3.1 For athletic grounds and golf course fairways a mixture composed of:

Eighty five (85%) percent Kentucky Bluegrass (100% Class 1 cultivars, 3 cultivars in equal proportion) and fifteen (15%) percent Perennial Ryegrass.

5.3.2 For general park areas, boulevards, medians and interchange areas a mixture composed of:

Sixty (60%) percent Kentucky Bluegrass (100% Class 1 or Class 2 cultivars, 3 cultivars in equal proportion), thirty (30%) percent Creeping Red Fescue and ten percent (10%) Perennial Ryegrass.

5.3.3 Wherever Kentucky Bluegrass is specified, the proportion of the cultivars to be included in the blend shall adhere to the following:

Class 1 Cultivars - specified blend of Class 1 cultivars shall consist of equal proportions of any three of the following:

Able 1	Absolute	Allure	Award	Baron
Bartitia	Blacksburg	Blackstone	Caliber	Challengedr
Chateau	Estate	Explorer	Kelly	Liberator
Limousine	Midnight	Misty	Northstar	NuGlade
Pick 151	Pick 8	Platini	Quantum Leap	Rambo
Rugby II	Serene	Shamrock	SR 2000	Total Eclipse
Touchdown	Unique	VB 16015	Wildwood	

Class 2 Cultivars - specified blend of Class 2 cultivars shall consist of equal proportions of any three of the following:

A 34	Abbey	Alpine	America	Apollo
Arcadia	Ascot	ASP 200	Banff	Baronie
Baruzo	Bluechip	Cardiff	Champagne	Chicago
Classic	Compact	Conni	Coventry	Crest
Cynthia	Dragon	Eclipse	Fortuna	Glade
Goldrush	Haga	Huntsville	Impact	Indigo
Jefferson	Kenblue	Langara	Lipoa	Livingston
Marquis	Mercury	Moonlight	Nimbus	NuBlue
NuStar	Odyssey	Park	Pepaya	Pick 3
Pick 4	Pick 855	Princeton 105	Raven	Rugby
Seabring	Sodnet	SR 2100	SR 2109	Washington

5.3.4 Wherever Perennial Ryegrass is specified, the entire proportion of the blend specified shall consist of any one of the following:

Admire	Charger II	Jet	Panther	Quest II
Affinity	Charismatic	Inspire	Paradigm	Racer
Advent	Churchill	IQ	Paragon	Racer II
Affirmed	Citation Fore	Kokomo	Passport	Radiant
All Star 2	Courage	Koos R-71	Pearl II	Renaissance
Allsport	Cruiser	Lp 1	Pennant	Salinas
Amazing	Dazzle	Line Drive	Pennant II	Secretariat
Applaud	Divine	Linn	Pentium	Seville II
Arrival	Edge	LS 2100	Phantom	Skyhawk
Ascend	Elka	Mach 1	Pick EX2	Splendid
Barlennium	Elfkin	Majesty	Pick PRNGS	Stellar
Blazer IV	Exacta	Manhattan 2	Pinnacle II	Summerset
Brightstar	Extreme	Manhattan 3	Pizzazz	Sunkissed
Brightstar II	Fiesta 3	Manhattan 4	Pleasure XL	Superstar
Buccaneer	Gallery	Mepy	PR 1-94	Terradyne
BY-100	Gator	Monterey II	Premier	Wilmington
Cabo	Gator 3	MP 103	Premier II	Yatsugreen
Calypso II	Grand Slam	Nighthawk	Promise	
Catalina	Hawkeye	Nexus	Prosport	
Catalina II	Headstart	Pacesetter	Protyme	
Cathedral II	Icon	Palmer II	Prowler	

5.3.5 Prior to payment for the seeding operation the Contractor shall provide the Contract Administrator with a copy of an invoice or a shipping bill received from the seed distributor specifying the quantities of each type of seed supplied for the Work Site and the delivery date.

5.3.6 Any variations to the above referenced seed blends or mixtures shall be approved by the Contract Administrator prior to sowing.

5.4 Herbicides

Herbicides shall be standard commercial products registered for sale and use in Canada under the Pest Control Products Act.

5.5 Insecticides

Insecticides shall be standard commercial products registered for sale and use in Canada under the Pest Control Products Act.

5.6 Hydro Mulching

5.6.1 Mulch

Mulch shall be wood cellulose fibre product free of germination or growth-inhibiting ingredients and shall form, after application, a blotter-like ground cover, which will allow absorption and percolation of water.

Mulch shall be dry, free of weeds and all foreign matter.

5.6.2 Water

Water used for hydro mulching shall be free of any impurities, which would inhibit germination, or otherwise adversely affect grass growth.

5.6.3 Tackifier

All wood cellulose fibre mulch shall be applied in slurry containing a tackifier at a rate as directed by the manufacturer.

9. CONSTRUCTION METHODS

9.1 Site Safety and Traffic Control

Where work is to be done in boulevard and median areas adjacent to roadways, the Contractor shall maintain traffic and ensure that protection is afforded to the road user and that the Contractors operations in no way interfere with the safe operation of traffic.

The Contractor shall supply, erect and maintain all applicable traffic control devices in accordance with the provisions of the latest edition of the Manual of Temporary Traffic Control in Work Areas on City Streets issued by the Public Works Department of the City of Winnipeg.

9.2 Site Grading

Site grading will be done and paid for in accordance with Specification CW 3110.

9.3 General

The Contractor shall not commence seeding operations until the finished topsoil surface is inspected and approved by the Contract Administrator.

The Contractor shall provide the Contract Administrator with a minimum of two working days notice for inspection of the finished topsoil surface.

9.4 Topsoil and Finish Grading

Preparation of the finished topsoil surface shall be completed in accordance with Specification of CW 3540.

To prevent the formation of depressions or water pockets, the Contractor shall smooth out any undulations or irregularities in the topsoil surface resulting from fertilizing, seeding, rolling or other operations.

9.5 Seeding

Grass seed shall be sown at a rate of 1.0 kilogram per 100 square metres.

The Contractor shall sow the seed into the approved seed bed by using seeding equipment suitable for the area involved and to the satisfaction of the Contract Administrator. Seed shall be embedded into soil to a depth of 5mm within 1 hour of sowing.

All seeded areas shall be rolled with a mechanical roller of a minimum weight of 220kg and minimum width of 760mm to form a uniform even surface, level with adjoining curbs, sidewalks or sod.

Water shall be applied in sufficient quantities and frequencies to obtain seed germination and growth. Watering shall be controlled to prevent seed washout. All costs to provide water for seeded areas shall be borne by the Contractor. These costs may include hydrant permit and meter rental fees.

Seeding operations shall be completed within two working days after the commencement of sowing operation. This shall include the application of seed, hydro mulching, rolling and watering.

No seeding shall be done on frozen soil, or when any other conditions unfavourable to successful seed germination exist.

Where the Contractor sows seed, and termination of the Maintenance Period is not achieved in accordance with Clause 9.10 in the same year that the seed was sowed, the Contractor shall be responsible for spring replacement of any seeded areas damaged over the winter due to winter-kill, ice damage, sand/salt applications on adjacent streets, or from snow removal or spring clean-up equipment.

9.6 Hydro Mulching

The Contractor shall not commence the hydro mulch application until the seeded area has been inspected and approved by the Contract Administrator.

The Contractor shall provide the Contract Administrator with a minimum of two working days notice for inspection of the seeded area.

The slurry mixture shall be mixed as per manufacturers recommendations and applied evenly over the prepared surface using equipment approved by the Contract Administrator. Apply slurry mixture within 24 hours of seeding at a rate of not less than 200 kilograms per 1000 square metres.

9.7 Commencement of Maintenance Period

Immediately after the completion of the seeding operation, to the satisfaction of the Contract Administrator, the Contractor shall commence and pay for continuous maintenance of the seeded area until the criteria specified for Termination of the Maintenance Period in Clause 9.10 has been met.

Any deficient, damaged or vandalized areas shall be reseeded by the Contractor within three working days after receiving notification from the Contract Administrator and the area so reseeded, shall be further maintained until it meets the criteria specified in Clause 9.10.

In situations where commencement of the Maintenance Period is not granted by the Contract Administrator before the end of a growing season, the Maintenance Period will commence on May 15 of the following year or such date as is mutually agreed upon by all parties.

9.8 Maintenance of Seeded Area

The Contractor shall mow the turf area at regular intervals to a height of 50 - 60 mm. Do not cut more than thirty (30%) percent of the grass height at any one mowing. Remove clippings that will smother grassed areas.

The Contractor shall water all seeded areas in sufficient quantities and frequencies to maintain seed germination and grass growth. Any damage, which may occur through washout of the soil during the maintenance period shall be repaired and maintained until it meets the criteria specified in Clause 9.10. All costs to provide water for seeded areas shall be borne by the Contractor. These costs may include hydrant permit and meter rental fees.

The Contractor shall clean and remove all dead vegetation, leaves, debris and snowmold from turf areas to encourage healthy and uniform grass growth.

Given the need for weed control, the Contractor shall have in his possession a Pesticide Applicator's License and a Pesticide Use Permit for pesticide applications related to this Specification.

The Contractor shall apply herbicide when broadleaf weeds start developing in competition with grass. Apply herbicide in accordance with the City of Winnipeg Weed Control Standards and Procedures, manufacturer's instructions and the Manitoba Agriculture Guide to Crop Protection and Herbicide Recommendations for Landscape Applicators, latest editions and the following criteria:

i. Use 2,4-D Amine or MCPA Amine herbicide for susceptible broadleaf weeds.
ii. Use a mixture containing 2,4-D Amine or MCPA Amine, Mecoprop and Dicamba for 2,4-D resistant plants.
iii. Do not apply to newly seeded turf until after the second or third mowing.
iv. Do not water within one working day after application.
v. Apply when winds are less than 20 km/h and air temperature is above 10° (degrees) Celsius.
vi. Avoid use of pure Dicamba solutions near trees and shrubs.

Given the need for insect control, the Contractor shall have in his possession a Pesticide Applicator's License and a Pesticide Use Permit for pesticide applications related to this Specification. Use standard commercial products in accordance with the manufacturer's instructions and the Manitoba Agriculture Guide to Crop Protection (latest edition) for the particular insect/insects involved.

Copies of the Pesticide Applicator's License and the Pesticide Use Permit must be submitted to the Contract Administrator prior to commencement of pesticide application.

All persons handling pesticides shall be fully aware of toxicological rules and regulations governing their use.

The Contractor shall inform the Contract Administrator immediately of any dangerous occurrence.

9.9 Spring Clean Up

Where termination of the maintenance period has not been achieved in accordance with Clause 9.10 prior to the end of a growing season, the Contractor shall complete all operations related to the clean up of the Work Site in the following spring. This shall include the cleaning and removal of all dead vegetation, leaves, debris, snowmold and any sand or gravel resulting from winter sanding/de-icing operations from turf areas to encourage healthy and uniform grass growth.

All costs for spring clean up operations, including reseeding of areas damaged over the winter shall be borne by the Contractor if in the previous year, seed was sowed, and the termination of the maintenance period in accordance with Clause 9.10, was not achieved in that same year or where the damage was due to defective seed or maintenance not conforming to this Specification.

9.10 Termination of Maintenance Period

The Contract Administrator will terminate the maintenance period after the following criteria has been met:

i. The certified seed sowed meets the requirements specified in Clause 5.3.
ii. The seeded area is free of any visual obstructions such as leaves.
iii. The seeded area has been rolled and has a firm, uniform even surface.
iv. The seeded area has established into a healthy, vigorously growing condition.
v. The seeded area is free of bare and dead spots and without more than ten (10) broadleaf weeds per fifty (50) square metres.
vi. The seeded area has sufficient shoot growth density that no surface soil is visible when the grass has been cut to a height of 50 - 60 mm.
vii. Seeded area is cut to a height of 50 - 60 mm within one working day before the final inspection.
viii. Edges of established seeded areas adjacent to shrub and flower beds are well defined.
ix. Seeded area is free of any turf damaging insects.

When the Contractor considers that the seeded area meets the criteria listed above, he shall arrange, attend and assist in the inspection of the Work with the Contract Administrator for purposes of verifying whether the Maintenance Period can be terminated. Any deficient, damaged or vandalized areas may have to be reseeded within three working days after receiving notification from the Contract Administrator and the area so reseeded, shall be further maintained by and at the expense of the Contractor in accordance with Clauses 9.7 and 9.8 herein.

In situations where the termination of the maintenance period is not granted by the Contract Administrator before the end of a growing season, the maintenance period will commence as described in Clause 9.7.

9.11 Site Clean Up

During both seeding and maintenance operations, all sidewalks, streets, approaches, driveways and properties near the seeding operations shall be kept clean at all times by the Contractor.

Upon completion of the project, the Contractor shall immediately remove all excess material and debris from the Work Site.

12. METHOD OF MEASUREMENT

12.1 Seeding

Supply, placement and maintenance of seed will be measured on an area basis. The area to be paid for shall be the total number of square metres seeded and maintained in accordance with this Specification and accepted by the Contract Administrator, as computed from measurements made by the Contract Administrator. No payment will be made for seeding placed outside of the limits of placement as directed by the Contract Administrator.

13. BASIS OF PAYMENT

13.1 Seeding

Supply, placement and maintenance of seed will be paid for at the Contract Unit Price per square metre for "Seeding", measured as specified herein, which price shall be payment in full for supplying all materials and for completing all operations herein described and all other items incidental to the work included in this Specification. Payment for seeding shall be in accordance with the following:

- Sixty five (65%) percent of quantity following supply and placement.

- Remaining thirty five (35%) percent of quantity following termination of the maintenance Period.

CW 3540 – TOPSOIL AND FINISH GRADING FOR ESTABLISHMENT OF TURF AREAS

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CW 3540 - TOPSOIL AND FINISH GRADING FOR ESTABLISHMENT OF TURF AREAS

1. GENERAL CONDITIONS

The General Conditions and Standard Provisions attached hereto shall apply to and be a part of this Specification.

3. DESCRIPTION

This Specification shall cover the supply and placing of topsoil for areas to be sodded or seeded.

The work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies and all other things necessary for an incidental to the satisfactory performance and completion of all work as shown on the Drawings and hereinafter specified.

5. MATERIALS

5.1 General

The Contractor shall be responsible for the supply, safe storage and handling of all materials set forth in this Specification. All materials supplied under this Specification shall be subject to inspection and testing by the Contract Administrator and/or the City's designated turf inspector. There shall be no charge to the City for any materials taken by the Contract Administrator or the City's designated turf inspector for inspection and testing purposes.

Topsoil will be subject to tests for nitrate, phosphate, potassium, sulphate, pH, E.C. (salinity) and volume of organic matter by a testing laboratory designated by the Contract Administrator.

The Contract Administrator and/or the City's designated turf inspector will collect as many samples as are deemed necessary to ensure that a good representation of the entire topsoil shipment is provided for the soil analysis report.

5.2 Topsoil

All topsoil required shall consist of a screened clay-textured or loam-textured dark topsoil, a fertile, friable material neither of heavy clay nor of very light sandy nature containing by volume, a minimum of four (4%) percent for clay loams and two (2%) percent for sandy loams to a maximum twenty-five (25%) percent organic matter (peat, rotted manure or composted material) and capable of sustaining vigorous plant growth. Topsoil shall be free of subsoil contamination, roots, stones over 25mm in diameter, baler twine or subsoil clay lumps over 25mm in diameter and other extraneous matter. Topsoil shall not contain quackgrass rhizomes, Canada thistle roots or other noxious weeds. Upon delivery or thirty (30) days following delivery, salinity rating shall be less than 4.0mm hos/cm on a saturated paste basis. The pH range shall be between 6.0 - 8.0.

Topsoil may be either on-site topsoil or imported topsoil.

On-site topsoil which has been stockpiled, can be reused providing that it is shredded or screened prior to being re-spread and that it meets the requirements specified above for topsoil.

Topsoil shall not be blow-in dirt taken from wind erosion sites and topsoil shall not be taken from fields abandoned to corn production where such soil may contain soil incorporated herbicides, such as eradicane and atrazine with lasting residual effects.

The Contractor shall inform the Contract Administrator of proposed source of topsoil to be supplied. The Contract Administrator reserves the right to reject topsoil not conforming to the requirements of this Specification.

5.3 Fertilizer

Chemical fertilizer with an N-P-K analysis of 1-2-1 ratio at a rate to provide 48 kg actual Nitrogen, 96 kg actual Phosphate and 48 kg actual Potassium per hectare.

Fertilizer shall be standard commercial brands meeting the requirements of the Canada Fertilizer Act and the Canadian Fertilizer Quality Assurance Program.

All fertilizers shall be granular, pelletized or pill form, and shall be dry and free flowing.

9. CONSTRUCTION METHODS

9.1 Site Safety and Traffic Control

Where work is to be done in boulevard and median areas adjacent to roadways, the Contractor shall maintain traffic and ensure that protection is afforded to the road user and that the Contractor's operations in no way interfere with the safe operation of traffic.

The Contractor shall supply, erect and maintain all applicable traffic control devices in accordance with the provisions of the latest edition of the Manual of Temporary Traffic Control in Work Areas on City Streets issued by the Public Works Department of the City of Winnipeg.

9.2 Preparation of Existing Grade

Subsoil shall be graded in accordance with Specification CW 3110 to eliminate uneven areas and low spots, ensuring positive drainage. Any soil contaminated by toxic materials shall be removed and disposed off site.

All surface debris, roots, vegetation, branches and stones in excess of 25mm shall be removed.

Grades on the area to receive topsoil that have been previously established in conformance with the Construction Drawings and/or other applicable specifications shall be maintained in a true and even grade.

Prior to placing topsoil, all sub-grade areas within athletic fields and all athletic field "run out" areas as Identified on the construction drawings shall be scarified to a minimum depth of 75mm.

9.3 Placing of Topsoil

The Contractor shall not commence placement of topsoil until the sub-grade has been inspected and approved by the Contract Administrator.

The Contractor shall provide the Contract Administrator with a minimum of two working days notice for inspection of required grading.

The topsoil mix shall be applied to a minimum of 75 mm compacted depth for areas requiring sod and a 100 mm compacted depth for seeding areas. All areas shall be rolled with a mechanical roller of a minimum weight of 220kg and minimum width of 760mm.

Topsoil shall be manually spread around trees, shrubs and other obstacles.

The Contractor shall ensure that topsoil does not come in contact with new asphaltic concrete pavement that is less than 2 weeks old.

9.4 Application of Fertilizer

The Contractor shall provide the Contract Administrator with a report for each work site indicating the fertilizer formulation used, the rate of application and the date of application.

Fertilizer shall be spread uniformly over the entire area of topsoil at a rate to provide 48 kg actual Nitrogen, 96 kg actual Phosphate and 48 kg actual Potassium per hectare.

9.5 Finish Grading and Rolling

The area shall be fine graded and the topsoil loosened. Eliminate rough spots and low areas to ensure positive drainage. Prepare a loose friable bed by means of cultivation and subsequent raking.

Topsoil shall be rolled with a mechanical roller of a minimum weight of 220kg, minimum width of 760mm roller, to consolidate it in areas to be seeded or sodded, leaving the surface smooth, uniform, firm against deep foot printing and to the satisfaction of the Contract Administrator.

9.6 Site Clean-Up

All sidewalks, streets, approaches, driveways and properties near the Work Site shall be kept clean at all times by the Contractor.

Upon completion of the project, the Contractor shall immediately remove all excess material and debris from the Work Site.

12. METHOD OF MEASUREMENT

There shall be no separate measurement for the work associated with this Specification.

13. BASIS OF PAYMENT

Payment for work specified under this Specification is to be included with the price for either sodding or seeding.

CW 3550 – Chain Link and Drift Control Fence

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CW 3550 – Chain Link and Drift Control Fence

1. GENERAL CONDITIONS

The General Conditions and General Requirements shall apply to and be a part of this Specification.

3. DESCRIPTION

This Specification shall cover the supply and installation of chain link fencing and drift control fence.

The work to be completed by the Contractor under this Specification shall include the supply of all materials, and the furnishing of all superintendence, overhead, labour, equipment, tools and all other things necessary for and incidental to the satisfactory completion of all of the work as hereinafter specified.

5. MATERIALS

5.1 Drift Control Fence

5.1.1 Approved Products

Use only those materials listed as Approved Products for Surface Works. The Approved Products are available in Adobe Acrobat (.pdf) format at the City of Winnipeg, Corporate Finance, Material Management Internet site at: http://www.winnipeg.ca/matmgt/info.stm

5.1.2 Material Property Requirements

a) Colour – Safety Orange
b) Width – 1220 ± 50mm (4 feet ± 2inches)
c) Roll Length – 15.25m (50 feet) approximately
d) Roll Weight - 17.0 kg (40 lbs)
e) Material – High Density Polyethylene
f) Mesh Size – 65mm x 95mm (2.5”x3.75”)
g) Horizontal Ultimate Tensile Strength – 45 kg (100 lbs) minimum per average strand
Or 725kg (1600lbs) minimum per 1220mm (4 foot wide)
h) Vertical Ultimate Tensile Strength – 45kg (100 lbs) minimum per average strand
or 180 kg (400 lbs) minimum per lineal foot.

5.1.3 T-bar Steel Posts for Drift Control Fence

Steel posts for drift control fence shall be:
a) No. 2 – T-bar steel posts
b) Seven feet (7’) in total length
c) Weight - seven to nine pounds (7 – 9 lbs) minimum.
d) One side shall have a serrated edge

5.2 Chain Link Fence

5.2.1 General

All chain link fence materials shall conform to this Specification and the Canadian General Standards Board (CGSB) Specifications CAN/CGSB-138.1, CAN/CGSB-138.2 and CAN/CGSB-138.4. Where any contradictions occur, Specification CW 3550-R2 shall take precedence over CGSB Specifications.

5.2.2 Terminal Posts

Terminal posts, comprising of end, gate, corner and straining posts shall be standard seamless, continuous weld, schedule 40 hot dip galvanized steel pipe weighing 11.28 kg per lineal metre. Posts shall be supplied with weatherproof caps. Tubing, conduit or open seam material will not be accepted.

End, gate, corner and straining posts shall be of the lengths and dimensions shown in following table:

TABLE 1
CW3550-R2.1

Fence Height mm	Pipe Diameter (outside) mm	Pipe Length mm	Diameter & Depth of Conc. Pile * mm
1220	88.9	2440	300 x 1800
1830	88.9	3200	300 x 1800
2440	88.9	3810	300 x 1800
3050	88.9	4420	300 x 1800
3660	114.3	5030	400 x 1800
4880	114.3	6550	400 x 1800

* Only where concrete is specified for post installation

5.2.3 Line Posts

Line posts shall be standard seamless, continuous weld, schedule 40 hot dip galvanized steel pipe weighing 5.43 kg per lineal metre. Line posts for fence fabric that is to be 3660 mm and higher shall weigh 8.63 kg per lineal metre. Tubing, conduit or open seam pipe will not be accepted.

Line posts shall be supplied with weatherproof eye top caps to accommodate continuous horizontal top rail and shall be of the lengths and dimensions shown in the following table:

TABLE 2
CW3550-R2.2

Fence Height mm	Pipe Diameter (outside) mm	Pipe Length mm	Diameter & Depth of Conc. Pile * mm
1220	60.3	2440	250 x 1800
1830	60.3	3200	250 x 1800
2440	60.3	3810	250 x 1800
3050	60.3	4420	250 x 1800
3660	73.0	5030	250 x 1800
4880	73.0	6550	250 x 1800

* Only where concrete is specified for post installation

5.2.4 Top and Bottom Rails

Top rails, or bottom rails where specified, shall be standard, continuous weld, schedule 40 hot dip galvanized steel pipe weighing 3.38 kg per lineal metre. Top rails shall be 6700 mm in length and have an outside diameter of not less than 43 mm.

5.2.5 Top and Bottom Rail Sleeve Couplings

Top and bottom rail sleeve couplings shall be schedule 40, hot dip galvanized steel pipe, 171 mm long and 45 mm inside diameter to accommodate a 43 mm outside diameter top rail and manufactured specifically as a top/bottom rail sleeve coupling for chain link fence.

5.2.6 Fabric

Fabric shall be No. 9 gauge steel wire woven into a uniform 50 mm (2") diamond pattern mesh or as specified. Size of mesh shall be determined by measuring the minimum clear distance between the wires forming the parallel sides of the mesh. Permissible variation in size of mesh shall be 3 mm (1/8"). Diameter of wire shall be no less than 3.68 mm (0.145"). The top and bottom selvage shall be knuckled.

Fabric shall be zinc coated before weaving by the hot dip process to an average mass per unit area of not less than 490 g/m^2.

Mesh fabric shall not be excessively rough, or have blisters, sal ammoniac spots, bruises or flaking.

Chain link fabric shall have a minimum tensile strength of 415 MPa.

5.2.7 Bottom Tension Wire

Bottom tension wire shall be No. 6 gauge single strand galvanized steel wire.

5.2.8 Turnbuckles

Where turnbuckles are specified, they shall be drop forged steel and be hot dip galvanized. The average overall length shall be approximately 300 mm, with ends in the closed position. Bolt diameter shall be 10 mm and shall be capable of taking up a minimum of 150 mm slack.

5.2.9 Braces

Braces, shall be schedule 40 hot dip galvanized steel pipe, not less than 43 mm outside diameter and weigh 3.38 kg per lineal metre.

5.2.10 Fittings and Accessories

Tension bars shall be 5 x 19 mm galvanized flat steel and not less than 50 mm shorter than the height of the fabric with which they are to be used.

Tension bands shall be 3 x 19 mm galvanized flat steel c/w 8 x 32 mm galvanized carriage bolts and nuts.

Brace bands shall be 3 x 19 mm galvanized flat steel c/w 8 x 32 mm galvanized carriage bolts and nuts to fasten top rail receptacles to terminal posts.

Cut ends of tension bars shall be ground smooth to remove all sharp edges and burrs.

Fabric clips shall be No. 9 gauge aluminum alloy wire.

Weatherproof post tops/caps, receptacles, and fittings shall be of adequate strength and may be of aluminum alloy, malleable steel or pressed steel. All ferrous metals shall be hot dip galvanized.

5.2.11 Concrete

Where concrete piles are specified for post installation, the concrete shall conform to CW 2160 and be sulphate resistant type 50, minimum compressive strength of 25 MPa at 28 days, air content of 4% - 7%, maximum slump of 80 mm and a maximum size of course aggregate of 40 mm.

9. CONSTRUCTION METHODS

9.1 Drift Control Fence

Install Drift Control Fence in accordance with the manufacturer's instructions or as directed by the Contract Administrator.

9.2 Chain Link Fence

9.2.1 General

The Contractor shall install chain link fence in accordance with Clauses 9.2 to 9.9 herein and the Canadian General Standards Board Specification CAN/CGSB-138.3. Where any contradictions occur, Specification CW 3550-R2 shall take precedence over CGSB Specifications.

Survey bars and control monuments must be protected during construction in accordance with Clause 4 of CW 1100, Standard Provisions.

9.2.2 Post Installation

Terminal and line posts, except where otherwise specified, shall be installed to a depth equal to the difference between the proposed fence height and the specified pipe length shown in Clauses 5.2 and 5.3 herein. Use hydraulic equipment to push or pound posts into the existing ground.
Where concrete piles are specified for post installation, they shall be of the lengths and dimensions shown in Clauses 5.2 and 5.3 herein. Posts shall be set in the centre of the concrete pile. Tops of concrete piles shall be crowned or domed to shed water and be installed 100mm below the finished grade. Concrete piles shall be constructed in accordance with CW 2160.

Posts shall be plumbed and set to give correct alignment. Bending of posts to give correct alignment is not acceptable.

Weatherproof post tops/caps shall be securely attached to eliminate removal by hand. Eye top caps shall allow for the insertion of a top rail in a horizontal position.

Maximum spacing between centerline of posts shall not exceed 3050 mm.

Straining posts shall be installed at all sharp changes in grade and where directed by the Contract Administrator.

9.2.3 Fabric Installation

Fabric shall be stretched taut to the correct tension as specified by the manufacturer and to the Contract Administrator's satisfaction. Where posts have been installed in concrete piles, fence fabric shall not be installed until piles have cured for a period of not less than five (5) days. Fabric shall be installed on the outside of the fence unless requirement for installation on the inside of the fence is specified.

Clearance between bottom of fabric mesh and ground surface shall be no less than 40 mm or more than 50 mm unless otherwise indicated on the drawing or approved by the Contract Administrator.

Fabric clips shall be used to fasten the fabric to the top rail at 450 mm spacing and to line posts at 380 mm maximum spacing. Wires ties on the top rail and bottom rail or tension wire shall have a minimum of two twists around mesh.

Tension bars, bands and bolts shall be used to fasten the fabric to terminal posts. Maximum spacing for tension bands and bolts shall be 380 mm. Top of tension bars shall not protrude above the bottom of the top rail.

The bottom tension wire shall be stretched taut along the bottom of the fabric and securely attached to all terminal and line posts and attached to the bottom edge of the fabric at 450 mm maximum spacing using hog rings.

9.2.4 Turnbuckles

Where turnbuckles are specified for installation, they shall be used to stretch the bottom tension wire taut and be able to take up a minimum of 150 mm slack.

9.2.5 Braces

Braces, where specified only, shall be placed either horizontally or diagonally from the terminal post to the first adjacent line post. Braces shall be secured to posts in accordance with construction drawing details and/or to the satisfaction of the Contract Administrator.

Corner and straining posts shall have braces on both sides.

9.2.6 Mid Rails

Mid rails for 4880 mm high fences shall be installed at a height of 2440 mm above the finished grade in accordance with construction drawing details and/or to the satisfaction of the Contract Administrator.

9.2.7 Gates

Gate frames shall be made from schedule 40 hot dip galvanized steel pipe; not less than 43 mm outside diameter, electrically welded at all joints with ample bracing to provide a rigid frame free from sag or twist.

Gate height shall match the height of the fence unless otherwise specified.

No. 9 gauge chain link fabric as specified in Clause 5.6 herein shall be attached to gate panels in accordance with Clause 9.3 herein. Top and bottom fabric selvage shall be knuckled.

Gates shall be supplied and installed complete with hot dip galvanized malleable iron hinges, latches, chain holdbacks, and a gate latch suitable for padlock, which is accessible from either side. Gates 3000 mm or more in width shall have three hinges per section.

Hinges shall permit the gate to swing back 180° degrees in line with the fence and shall be installed so as not to permit easy removal of the gate.

If requested by the Contract Administrator, the Contractor shall supply shop drawings of all gates to be supplied prior to manufacture for the Contract Administrator's approval.

9.2.8 Zinc Coating Repairs

All abraded and damaged galvanized surfaces shall be cleaned and painted. Damaged surface areas shall be thoroughly grinded or wire brushed and all loose and cracked zinc coating removed, after which the cleaned area shall be painted with two coats of a zinc pigmented paint approved by the Contract Administrator for these purpose.

9.2.9 Site Clean-Up

All areas of the Work Site shall be kept clean at all times by the Contractor.

Upon completion of the project, the Contractor shall immediately remove all excess material and debris from the Work Site to the satisfaction of the Contract Administrator.

12. METHOD OF MEASUREMENT

12.1 Drift Control Fence

Supply and installation of Drift Control Fence shall not be measured for payment and shall be incidental to the Contract.

12.2 Chain Link Fence

Chain link fence will be measured on a linear measure basis. The quantity to be paid for will be the actual number of linear metres constructed in accordance with this Specification and accepted by the Contract Administrator, as computed from measurements made by the Contract Administrator.

12.3 Chain Link Fence Gates

Gates will be measured on a linear measure basis. The quantity to be paid for will be the actual number of linear metres constructed in accordance with this Specification and accepted by the Contract Administrator, as computed from measurements made by the Contract Administrator.

13. METHOD OF PAYMENT

13.1 Chain Link Fence

Chain Link fence will be paid for at the Contract Unit Price per metre for "Chain Link Fence"* measured as specified herein, which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the work included in this Specification.

* Specify the following:
* Height of the Chain Link Fence
* If Concrete is required for Line Posts or for Terminal Posts

13.2 Chain Link Fence Gates

Gates will be paid for at the Contract Unit Price per metre for "Gates", measured as specified herein, which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the work included in this Specification.

CW 3610 – INSTALLATION OF CULVERTS

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CW 3610 - INSTALLATION OF CULVERTS

1. DESCRIPTION

1.1 General

This Specification covers the supply and installation of culvert pipe, couplers and fittings for connections, removal, disposal, and abandonment of culvert pipe.

1.2 Definitions

.1 Foundation – The natural soil sub-grade or granular material to replace unsuitable soil.

.2 Bedding – Material placed over the Foundation to the centre elevation of the culvert.

.3 Backfill – Material placed over the Bedding and culvert to a minimum of 300mm above the top of the culvert or as directed by the Contract Administrator. This definition does not include pavements.

.4 CSP – Corrugated Steel Pipe

.5 HDPE - High Density Polyethylene

.6 PCP – Precast Concrete Pipe

1.3 Referenced Standard Construction Specifications

.1 CW 1130 – Site Requirements
.2 CW 2030 – Excavation, Bedding and Backfill
.3 CW 2130 – Gravity Sewers
.3 CW 2160 – Concrete Underground Structures and Works
.4 CW 3110 – Sub-grade, Sub-base, and Base Course Construction
.5 CW 3615 - Riprap
.6 Approved Products for Surface Works

2. MATERIALS

2.1 CSP and PCP Culverts, Fittings, and Accessories

.1 Supply CSP culvert, fittings and other accessories in accordance with this Specification and CSA Specification CAN/CSA-G40l.

.2 Supply PCP culvert and fittings in accordance with one of ASTM Specifications C-l4, C-76 or C-655.

2.2 High Density Polyethylene (HDPE) Pipe Culverts, Fittings and Accessories

.1 Supply HDPE culvert fittings and couplers in accordance with CSA B182.8.

.2 HDPE culvert fittings and couplers and shall be made of virgin high density polyethylene material. The HDPE culvert shall have a full circular cross section, be dual walled with a smooth inner liner and an outer corrugated pipe wall. HDPE culvert shall have a minimum

stiffness of 320kPa at 5 percent deflection in accordance with ASTM D2412.

.3 HDPE culvert lengths shall be coupled with a Type 3 Soil tight external split coupler or better.

2.3 Bedding and Backfill

.1 Supply Foundation, Bedding and Backfill material in accordance with Section 2 of CW 3110 and the Drawings.

.2 Clay, silt, or organic soil shall not be used as bedding or backfill material.

.3 Supply sand in accordance with Section 2 of CW 2030. Sand shall be used as a levelling course.

2.4 Capping for Side Slopes

.1 Supply impervious clay as capping for approach side slopes around the culvert.

2.5 Flowable Cement Stabilized Fill

.1 Supply flowable cement stabilized fill in accordance with Table 2160.1 in CW 2160.

2.6 Culvert End Markers

.1 Supply culvert end markers in accordance with the following:

.1 Culvert end markers shall be 1500 ± 100mm in height.

.2 Culvert end markers shall be HDPE, SDR 9.3, 30mm (1¼") in diameter, bright orange in colour with an adhesive backed reflective strip placed around the marker. The reflective strip shall be placed within 25mm of the top of the marker.

2.7 Approved Products

.1 Use only those products listed as Approved Products for Underground Use in the City of Winnipeg found on the City of Winnipeg, Materials Management web site at: http://www.winnipeg.ca/matmgt/info.stm

3. CONSTRUCTION METHODS

3.1 Excavation, Bedding and Backfill

.1 Excavate in accordance with CW 2030.

.2 Establish line and grade in accordance with the Drawings.

.3 Place and compact a Foundation below the proposed pipe and Bedding for commercial approaches and all other approaches as directed by the Contract Administrator.

.3 Place and compact Bedding material a minimum of 75mm below the invert grade of the

proposed pipe.

.4 Place sand as a levelling course over the Bedding material; sand is not to be used as Backfill.

.5 Place the culvert on the Bedding material to line and grade in accordance with Section 3.2 of this specification.

.6 Place and compact granular material on both sides of the culvert up to the center of the pipe, then Backfill and compact material in 150mm lifts.

.7 All Bedding and Backfill material shall be compacted to 95% Standard Proctor density.

.8 Place and compact Backfill to a depth above the top of the pipe in accordance with the manufacturer's specifications, excepting Section 3.2.4 of this Specification.

.9 Shape Backfill on the side slopes to be in accordance with SD-234 and SD-239.

3.2 Culvert Installation

3.2.1 General

.1 Use a minimum number of coupled sections to create one length.

.2 Install culvert to the line and grade on the Drawings or as set in the field by the Contract Administrator. Vertical variance from grade shall not exceed 25 mm and horizontal variance from line shall not exceed l00 mm without sharp bends.

3.2.2 Corrugated Steel Pipe (CSP) Culvert and Pipe Arch Culvert

.1 Install CSP culvert on the compacted Bedding with the separate sections securely joined together by means of tightly drawn coupling bands. For CSP culvert of the round or elongated type, and arch culvert, constructed from individual plates, lap the circumferential joints on the outside of the pipe section on the upstream end, and lap longitudinal seams at the side of the pipe.

.2 Install CSP culvert and pipe arch culvert with a two percent camber at its center.

3.2.3 Precast Concrete Pipe (PCP) Culvert

.1 Install PCP culvert installation in accordance with Specification CW 2130 for PCP pipe.

3.2.4 High Density Polyethylene Pipe (HDPE) Culvert

.1 Install HDPE culvert in accordance with the manufacturer's specifications except for private approaches, the minimum Backfill cover above the top of the pipe shall be 300mm or as directed by the Contract Administrator.

3.3 Connections to Existing Culverts

3.3.1 Corrugated Steel Pipe (CSP) and Pipe Arch Culvert

.1 Expose the end of the existing culvert without damaging the existing culvert for connection to an existing CSP culvert.

.2 Cut off sufficient length of sloped or damaged culvert to provide a straight end in acceptable condition for connection. Coat the end cut of the culvert with a galvanizing compound approved by the Contract Administrator.

.3 Connect new CSP culvert to existing CSP culvert in accordance with Clause 3.2.2 of this Specification.

3.3.2 Precast Concrete Pipe (PCP)

.1 Connect new PCP culvert to existing PCP culvert in accordance with Specification CW 2130 for PCP pipe.

3.3.3 Removal of Existing Culvert Pipe

.1 Remove existing culverts as directed by the Contract Administrator within the limits of the Contract.

.2 Separate coupled sections before removing culverts so as not to damage the culvert sections.

.3 Whenever a culvert is being removed but not replaced, backfill with suitable site material and compact in accordance with CW 3110.

3.4 Capping for Side Slopes

.1 Cap the side slopes around the culvert ends with impervious clay or as directed by the Contract Administrator or the Drawings.

3.5 Plugging and Abandonment of Existing Culvert

.1 Plug the ends of the culvert with concrete, mortar or sand bags, then pump in cement stabilized fill to fill the interior of the culvert.

3.6 Disposal of Existing Culvert

.1 Dispose of existing culvert in accordance with Section 3.4 and 3.5 of CW 1130.

3.7 Culvert End Markers

.1 Install culvert end markers on all new culverts and culvert end repairs.

.2 Anchor the culvert end markers to the top of both ends of the culvert by bolting with plated bolts, nuts and washers in field drilled mounting holes.

4. MEASUREMENT AND PAYMENT

4.1 Corrugated Steel Pipe (CSP)

.1 Supply and installation of CSP culvert shall be measured on a linear basis and paid for at the Contract Unit price per metre for the "Items of Work" listed below. The length to be paid for shall be the total number of metres of CSP culvert supplied and installed in accordance with this Specification, accepted and measured by the Contract Administrator.

Items of Work:

Corrugated Steel Pipe (CSP) Culvert
- i.) Supply*
- ii.) Install*

* Specify Diameter, Gauge, and the material type being either Galvanized, Aluminized Steel or Polymer Coat.

.2 Separate measurement shall be made for each diameter, gauge, and material type of culvert.

.3 The linear measurement of corrugated steel pipe shall be measured horizontally at grade above the centre line of the pipe culvert.

.4 Couplers and fittings shall be included in the payment for corrugated steel pipe (CSP) listed above.

.5 Excavation, Bedding and Backfill shall be included in payment for Corrugated Steel Pipe (CSP) Culvert and shall be incidental to the Contract.

4.2 Precast Concrete Pipe (PCP)

.1 Supply and installation of PCP culvert shall be measured on a linear measure basis and paid for at he Contract Unit Price per metre for the "Items of Work" listed below. The length of PCP culvert to be paid for shall be the total number of metres of PCP culvert supplied and installed in accordance with this Specification, accepted and measured by the Contract Administrator.

Items of Work:

Precast Concrete Pipe (PCP) Culvert
- i.) Supply*
- ii.) Install*

*Specify Diameter and Class of Culvert

.2 Separate measurement will be made for each diameter and class of culvert.

.3 The linear measurement of precast concrete pipe shall be measured horizontally at grade above the centre line of the pipe culvert.

.4 Gaskets, flexible rubber shall be included in the payment for precast concrete pipe listed above.

.5 Excavation, Bedding and Backfill shall be included in payment for supply and installation of Precast Concrete Pipe (CSP) culvert and shall be incidental to the Contract.

4.3 High Density Polyethylene Pipe (HDPE)

.1 Supply and installation of HDPE culvert shall be measured on a linear measure basis and paid for at the Contract Unit Price per metre for the "Items of Work" listed below. The length of HDPE culvert to be paid for shall be the total number of metres of HDPE culvert supplied and installed in accordance with this Specification, accepted and measured by the Contract Administrator.

Items of Work:

High Density Polyethylene Pipe (HDPE)
- i.) Supply*
- ii.) Install*

*Specify Diameter of Culvert

.2 Separate measurement will be made for each diameter of culvert.

.3 The linear measurement of High Density Polyethylene (HDPE) pipe shall be measured horizontally at grade above the centre line of the pipe culvert.

.4 Split couplers shall be included in the payment for High Density Polyethylene (HDPE).

.5 Excavation, Bedding and Backfill shall included in payment for "High Density Polyethylene Pipe and shall be incidental to the Contract.

4.4 Connections to Existing Pipe Culverts

.1 Connections to existing culverts shall be measured on a unit basis and paid for at the Contract Unit Price per unit for "Connections to Existing Culverts". The number of units to be paid for shall be the total number of connections installed in accordance with this specification, accepted and measured by the Contract Administrator.

.2 Couplers and necessary hardware, and removal and disposal of damaged or otherwise unacceptable lengths of existing culvert and excavation material shall be included in payment for "Connections to Existing Culverts".

.3 New culvert required to replace unacceptable existing culvert shall be measured and paid for in accordance with this Specification.

4.5 Plugging and Abandonment of Existing Pipe Culverts

.1 Plugging and abandonment of existing culverts shall be measured on a volume basis and paid for at the Contract Unit Price per cubic metre for "Plugging and Abandonment of Existing Culverts". The volume to be paid for shall be the total number of cubic metres of cement stabilized fill supplied and placed within the culvert in accordance with this specification, accepted and measured by the Contract Administrator.

.2 The volume of cement stabilized flowable fill will be calculated using the inside diameter and horizontal length of centre line of the existing culvert abandoned.

4.6 Removal of Existing Culverts

.1 Removal of existing culverts shall be measured on a linear measure basis and paid for at the Contract Unit Price per metre for “Removal of Existing Culverts”. The length to be paid for shall be the total number of meters of existing culvert removed in accordance with this Specification, accepted and measured by the Contract Administrator.

.2 The linear measurement of existing culvert pipe shall be measured horizontally at grade above the centre line of the pipe culvert.

.3 Excavation and disposal of surplus material due to removal of existing culverts or portions of damaged culvert, and unacceptable lengths of existing culvert shall be included in the payment for “Removal of Existing Culverts”.

.4 No payment shall be made for backfill of excavated area with suitable site material and shall be incidental to the Contract.

4.7 Disposal of Existing Culverts

.1 Disposal of existing culverts shall be measured on a linear measure basis and paid for at the Contract Unit Price per metre for “Disposal of Existing Culverts”. The length to be paid for shall be the total number of meters of existing culvert disposed in accordance with this Specification, accepted and measured by the Contract Administrator.

.2 The linear measurement of existing culvert pipe shall be measured horizontally at grade above the centre line of the pipe culvert.

4.8 Capping for Side Slopes

.1 No payment shall be made for capping for side slopes using clay and shall be incidental to the Contract.

4.9 Culvert End Markers

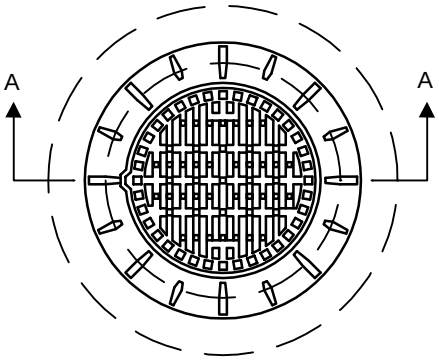
.1 Supply and installation of culvert end markers shall be measured on a unit basis and paid for at the Contract Unit Price per unit for the “Culvert End Markers”. The number of units to be paid for shall be the total number of culvert end markers supplied and installed in accordance with this Specification, accepted and measured by the Contract Administrator.

.2 No additional payment shall be made for culvert clamps, plated bolts, nuts and washers and are incidental to the Contract.

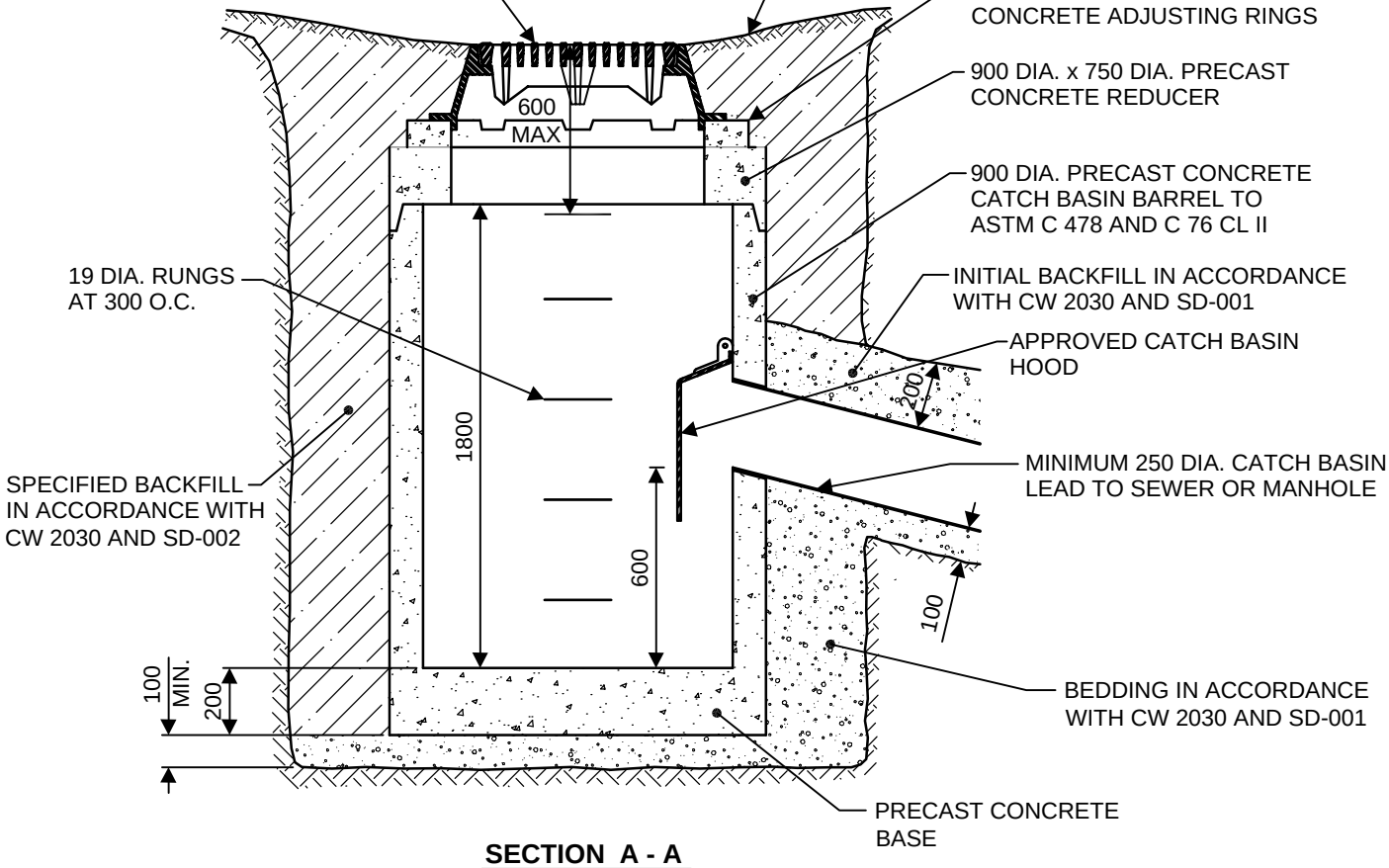
.3 One tube and set of hardware for installation to mark one end of a culvert is considered to be a culvert end marker.

NOTE: EACH CATCH BASIN TO HAVE SEPARATE CONNECTION TO SEWER OR MANHOLE

USE PREFORMED BITUMINOUS GASKET BETWEEN REDUCER AND BARREL SECTION



PLAN



SECTION A - A

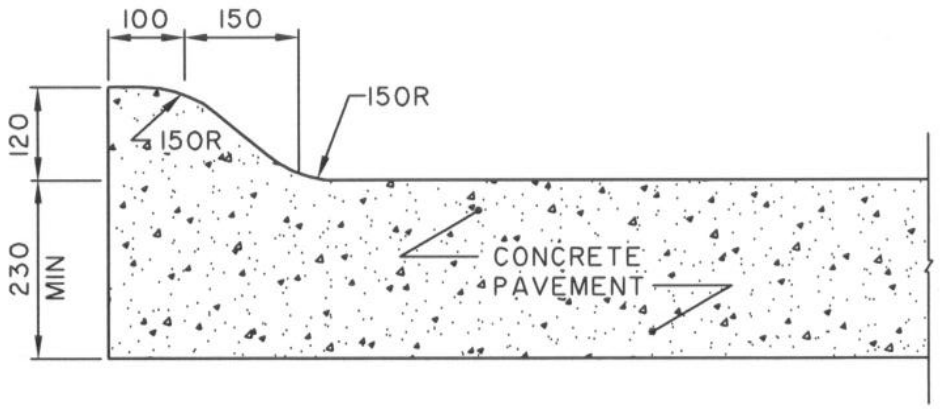
DIMENSIONS IN MILLIMETERS

THE CITY OF WINNIPEG
WATER & WASTE DEPARTMENT

Reference Spec. No.
CW 2030 CW 2130

STANDARD PRE-CAST CONCRETE CATCH BASIN IN BOULEVARD

Designed By: LSWL / TW	**Drawn By:** BH	**Scale:** N.T.S.
Checked By: TW	**Date:** 05-02-22 **Revision: 1**	**Drawing No.** SD-025
Approved: UNDERGROUND WORKS COMMITTEE		



NOTE: 1. APPLICABLE FOR MEDIAN CURBS ON STREETS WITH POSTED SPEEDS ≥ 80KPH.

2. TRANSVERSE SAW CUT EVERY 6000 OR AT PAVEMENT JOINTS.

DIMINSIONS ARE IN MILLIMETRES

THE CITY OF WINNIPEG
PUBLIC WORKS DEPARTMENT

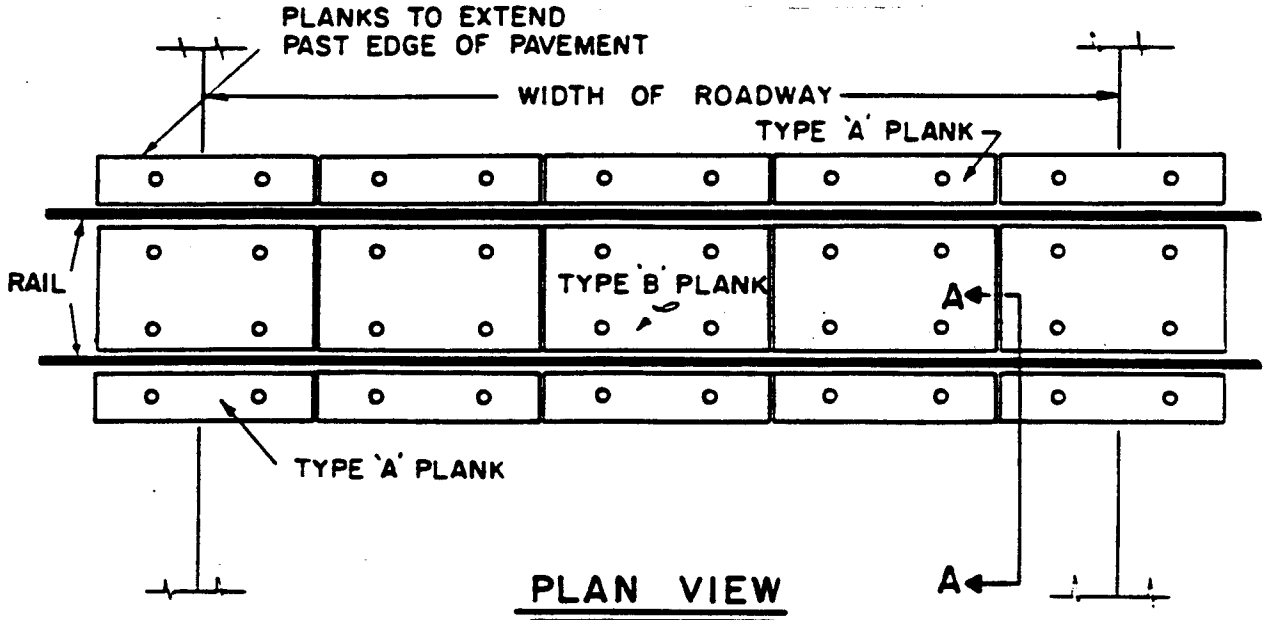
Reference Spec. No.
CW 3240, CW 3310

Revisions

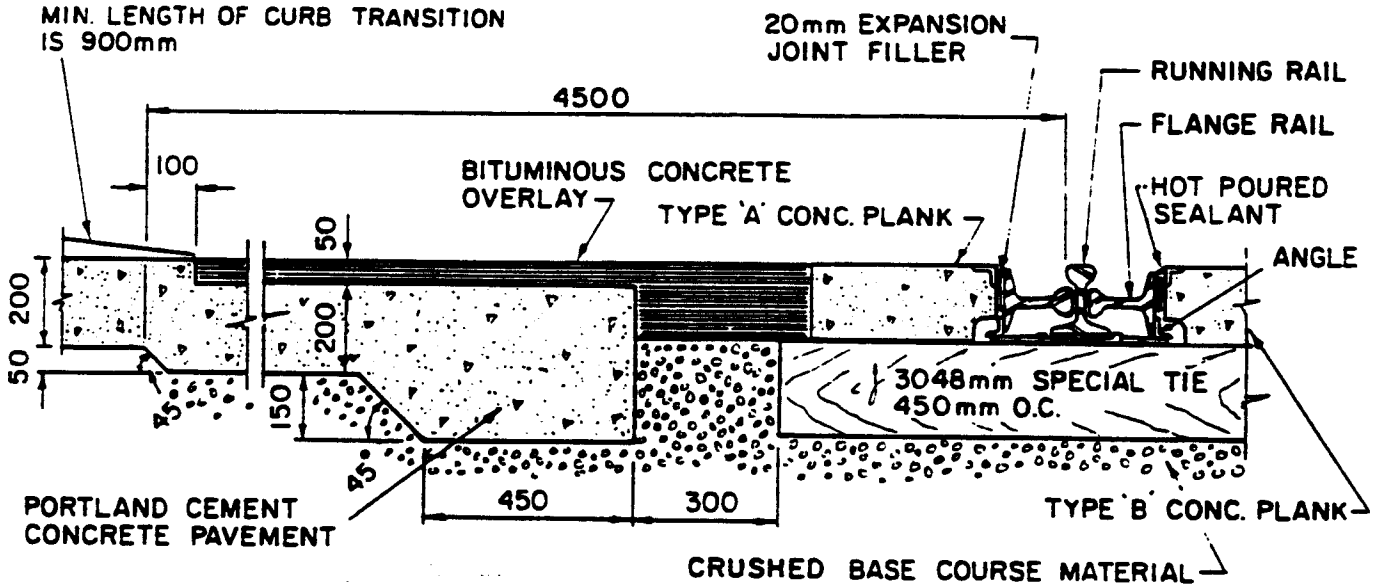
No.	Date	Description	By
1.	JAN 03	GENERAL REVISION	lwb

MOUNTABLE CURB

Designed By: B.P.	Drawn By: lwb	Scale : N.T.S.
Checked By: D.R.K.	Date: 03-01-28	Drawing No. SD-201
Approved: SURFACE WORKS COMMITTEE		



PLAN VIEW



SECTION A-A

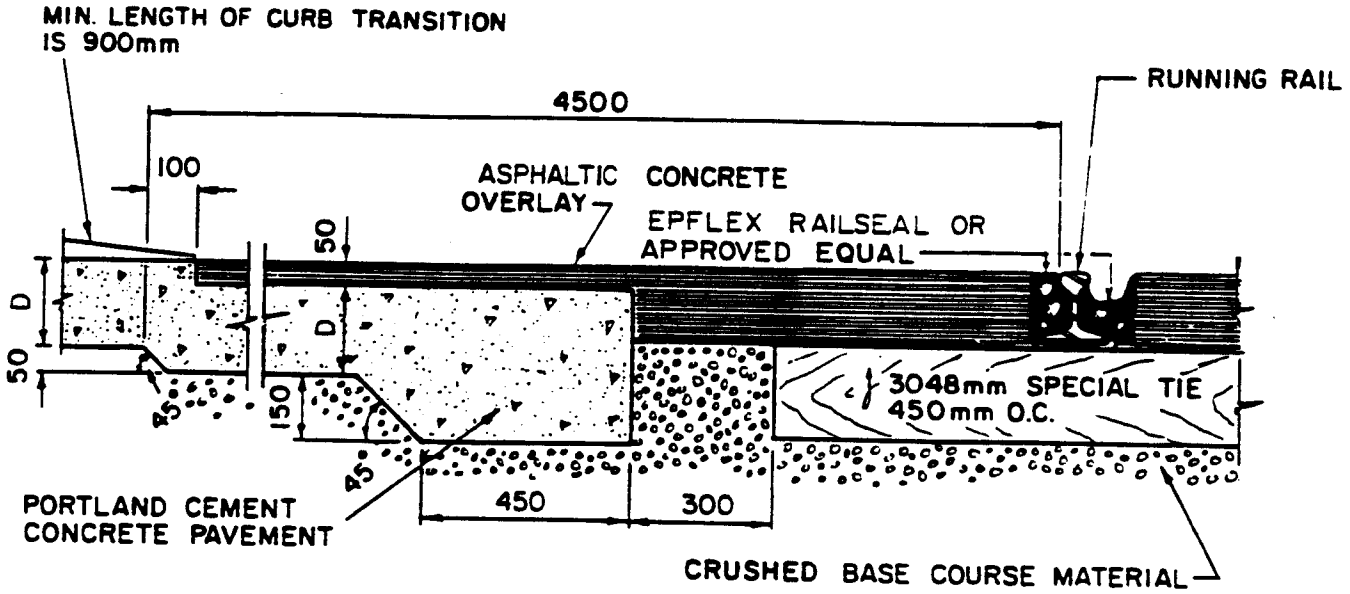
DIMENSIONS ARE IN MILLIMETRES

The City Of Winnipeg
Works & Operations Division

Reference Spec. No.
CW3230, CW3310, CW3410

TYPICAL RAILROAD CROSSING
UTILIZING CONCRETE PLANKS

Designed By:	Drawn By:	Scale:
LSW	H.N.	N.T.S.
Checked By:	Date:	Drawing No.
[signature]	81-02-16	SD-230
Approved: [signature]		



SECTION A-A

DIMENSIONS ARE IN MILLIMETRES

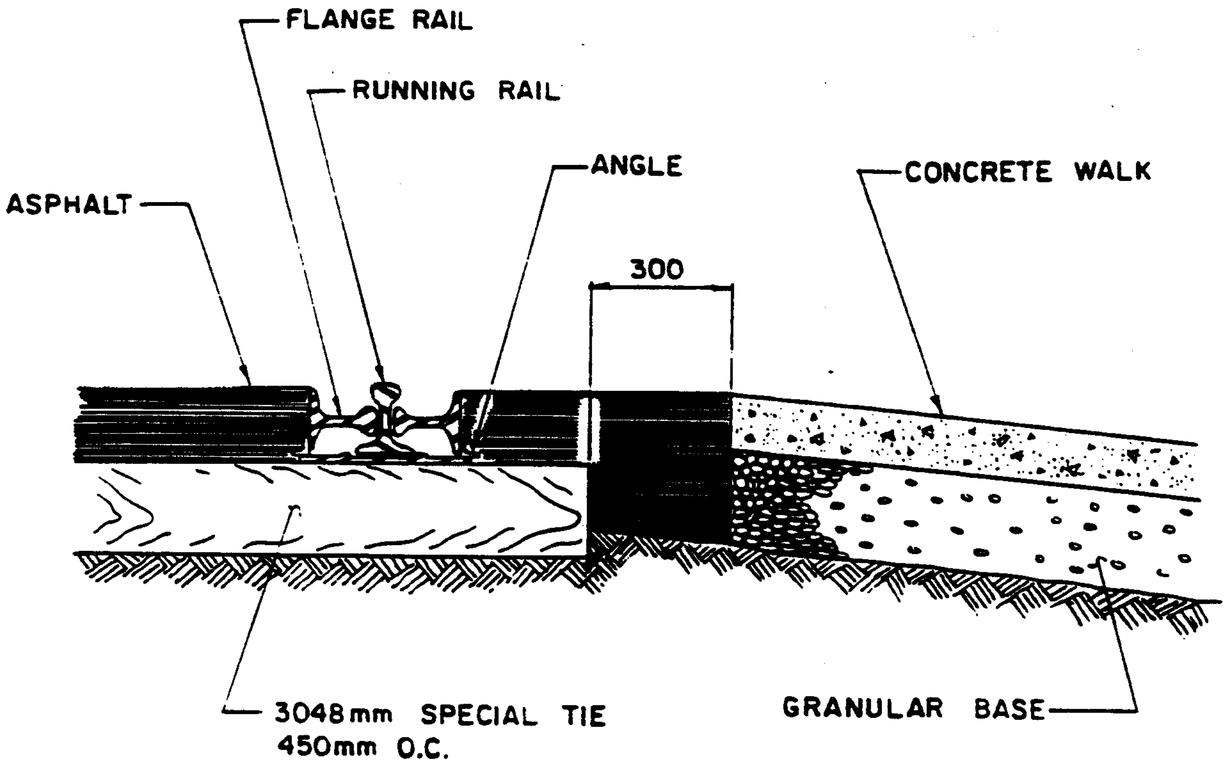
REV. OCT. 1990

The City Of Winnipeg
Works & Operations Division

Reference Spec. No.
CW 3230, CW 3310, CW 3410

TYPICAL RAILROAD CROSSING
UTILIZING ASPHALTIC CONCRETE

Designed By:	Drawn By:	Scale:
LSW	HN	N.T.S.
Checked By:	Date:	Drawing No.
[illegible]	86 04 09	SD-231A
Approved:		



The City Of Winnipeg Works & Operations Division		Reference Spec No. CW 3410	
TYPICAL RAILROAD SIDEWALK CROSSING	Designed By: H.N.	Drawn By:	Scale: N.T.S.
	Checked By	Date 86 04 09	Drawing No. SD-231B
	Approved		