DIVISION 4

SPECIFICATIONS FOR DRAINAGE RELATED ITEMS

INDEX

SECTION 401

DITCHING FOR STREAMS

INDEX

401.01 DESCRIPTION

All stream channel excavations pertaining to the drainage of the highway, whether within the limits of the right of way or not, shall be considered part of the contract. All materials excavated from ditches if suitable for constructing roadway fills shall be incorporated into fill construction in accordance with Section 204. Materials not suitable for roadway fills shall be deposited in flat waste banks, where acceptable, and shall be levelled and trimmed to sightly proportions and contours to the Owner's Representatives satisfaction.

Contractors are reminded that Division 8 applies to all work associated with this specification.

In swamps, bogs and other wet areas, the Contractor if he so desires, may excavate ditches to the satisfaction of the Owner's Representative by the use of ditching dynamite.

The term "Ditching for Streams" will include all excavations lying beyond the actual ends of footings for culverts and other drainage structures, and will include excavations for stream diversions.

The Contractor shall carry out the work in such a way so as to cause a minimum of disturbance and siltation to the water course and not to impact water quality.

Water courses carrying water shall not be blocked off until alternative water courses are completed and able to carry the water. The new channel shall be excavated in the dry. The channel bottom and side slopes shall be constructed of stable non-erodible material. When the new channel is completed, the old channel shall be closed off with impervious non-erodible material.

Care shall be taken to prevent fish being stranded in closed off diversions. Any fish that are stranded must be captured and transferred to the new stream.

The Contractor shall excavate the ditches to the lines, grades and cross section limits staked by the Owner's Representative.

The Contractor shall minimize the crossing of water courses by heavy equipment. The same crossing place shall be used for such crossings as are unavoidable. At the completion of operations, the crossing place shall be put back to its original condition.

401.02 MEASURMENT FOR PAYMENT

Measurement will be made in excavation and will be from the cross section sheets showing the original ground lines and the completed and accepted excavation lines as cross sectioned. The volume of this excavation to be computed by the average end area method of computation or as wedges or pyramids, as the case may be, when terminating at grade points.

Excavation below grade, or beyond the cross section limits staked will not be measured for payment.

No allowance will be made for material excavated before original cross sections have been made.

The volume for payment shall be measured in cubic metres, rounded to the nearest whole number.

401.03 BASIS OF PAYMENT

Payment shall be at the Contract Unit Price per cubic metre for either Ditching for Streams, Solid Rock, hauled 1 kilometre or under, or Ditching for Streams, Other Material hauled 1 kilometre or under, as the case may be, and such payment will be compensation in full for all labour, materials and equipment use required to carry out the operations herein described.

However, should the contract not include quantities for Ditching for Streams, Solid Rock hauled 1 kilometre or under, then all required excavation of solid rock for ditching of streams will be paid for at the contract price for "Ditching Solid Rock hauled 1 kilometre or under".

Should the contract not include quantities for ditching for streams, other material hauled 1 kilometre or under, then all required excavation of other material for ditching of streams will be paid for at the contract price for "Ditching Other Material Hauled 1 kilometre or Under".

However, where the Owner's Representative requires that materials excavated from ditches be hauled in excess of the 1 kilometre freehaul before being placed, additional payment for overhaul will be made in accordance with Section 215.

SECTION 402

PERMANENT RELOCATION OF STREAMS

INDEX

402.01 SCOPE

The purpose of this specification is to state the general requirements for the provision of various types of work and features which may be required for the permanent relocation of streams.

402.02 ENVIRONMENTAL REQUIREMENTS

Contractors are reminded that Division 8 applies to all work associated with this specification.

402.03 CUTTING TREES AND BRUSH FOR RELOCATION

The proposed stream relocation site shall be cut to the limits as flagged by the Owner's Representative. This work shall be carried out and paid for according to the provisions of Section 202. Care shall be taken not to cut those particular trees and bushes designated for saving as cover for fish. Such trees and bushes shall be marked for saving by the Owner's Representative.

402.04 GRUBBING FOR STREAM RELOCATION

The Contractor shall only grub within the limits flagged by the Owner's Representative. In order to prevent possible future erosion and siltation, grubbing shall be strictly confined to within those areas that are to be excavated. The limits for grubbing will normally be from the proposed stream bank on one side to the proposed stream bank on the other side. Where possible, a buffer strip (minimum of 15 metres) shall be left between the existing stream channel and the new channel.

The grubbing shall be carried out and paid for in accordance with Section 203.

402.05 EXCAVATION OF CHANNEL

The channel shall be excavated to the lines, cross sections and grades staked by the Owner's Representative. The channel shall be excavated in the dry. Channel side slopes shall not be steeper than 2:1. The natural vegetated cover including grasses, low lying shrubs and bushes shall not be disturbed adjacent to the banks so to prevent erosion and siltation. The excavated material shall be removed from the site and used as construction fill. If unsuitable as construction fill, it shall be disposed of at a disposal site approved by the Owner's Representative.

If site conditions permit (minimal impact on vegetation and trees, erosion and water quality), excavated material can be placed in berms not less than 5 metres from the new channel. The berms shall be graded and trimmed to sightly proportions in preparation for future hydroseeding or sodding.

Particular care shall be taken in excavating the channel so as to incorporate features that will render the channel habitable by fish. The channel alignment shall be irregular like a natural stream channel. The alignment shall have varying cross sections, an uneven profile and frequent meanders so as to create a riffle and pool environment in the completed stream relocation.

Measurement for payment shall be by the number of cubic metres of excavated material as shown between the position of the ground lines as cross sectioned after grubbing operations have been completed, and the completed and accepted excavation lines. Material excavated outside of the required limits will not be included in measurement for payment. The volume of the excavation to be computed by the average end area method of computation or as wedges or pyramids, as the case may be, when terminating at grade points.

During excavation operations whenever the character of material changes from Other Material to Solid Rock the Contractor shall strip the area within the limits of all overlying material and notify the Owner's Representative, in order that proper measurements for cross sections may be made. No allowance will be made for material excavated before such measurements or cross sections have been made.

For boulders present in Other Material; the three maximum rectilinear dimensions of boulders, actually excavated, will be measured and the volume of each so determined. Volumes of the boulders which are equal to, or greater than, 0.5 cubic metres will be included for payment as rock.

Payment shall be at the contract price per cubic metre for either Excavation of Channel for Permanent Relocation of Streams, Solid Rock, hauled 1 kilometre or under; or Permanent Relocation of Streams, Other Material, hauled 1 kilometre or under, as the case may be. Such payment shall be compensation in full for all labour, materials and use of equipment to: excavate the material from within the required horizontal alignment, cross sections and profile, then load and transport the material up to the 1 kilometre freehaul limit and place and compact the material in a fill, or in the case of waste material place and trim the material in berms.

Where the Owner's Representative requires that excavated materials be hauled in excess of the 1 kilometre freehaul limit before being placed, additional payment for overhaul will be made in accordance with Section 215.

Should the contract not include quantities for "Excavation of Channel for Permanent Relocation of Streams, Solid Rock", then payment for that quantity shall be at the contract price for "Excavations for Foundations, Solid Rock".

Likewise, should the contract not include quantities for "Excavation of Channel for Permanent Relocation of Streams, Other Material", then payment for that quantity shall be at the contract price for "Excavation for Foundations, Other Material".

402.06 HYDRAULIC RIP RAP

Should the channel bed or sides require Hydraulic Rip Rap treatment, then this work shall be carried out and paid for in accordance with Section 917.

402.07 RIP-RAP FOR CHANNEL

Should the channel bed or sides require rip rap treatment, then this work shall be carried out and paid for in accordance with Section 610.

402.08 SMALL SHOT ROCK FOR CHANNEL BED

Should small shot rock be required to line the channel bed, then the small shot rock shall be placed on the excavated channel bed in a layer no thicker than one piece of shot rock thick. Care shall be taken not to place any appreciable depth of shot rock, so as to help avoid the stream becoming a "French Drain" during periods of low flow.

The small shot rock shall be well shattered with no pieces larger than 100 millimetres, and be placed to the satisfaction of the Owner's Representative.

Measurement for payment shall be on the basis of the number of cubic metres, rounded to one decimal place, of the small shot rock placed within the limits required by the Owner's Representative. The volume shall be calculated from the computed surface area multiplied by a nominal thickness of 0.1 metres.

Payment at the contract price for small shot rock for channel bed, shall be compensation in full for all labour, materials and use of equipment to supply and place the small shot rock, as specified.

402.09 GABIONS FOR CHANNEL

Should gabions be required for the channel, then the gabion work shall be carried out and paid for in accordance with Section 601.

402.10 WASHED GRAVEL FOR CHANNEL BED

Should washed gravel be required in the channel bed, the washed gravel shall consist of aggregate all of which passes the 20 millimetre sieve, but none passes the 1.25 millimetre sieve. The gravel shall be washed.

The washed gravel shall be placed after the Hydraulic Rip Rap, Rip Rap, Stream Rock or Small Shot Rock has been placed in the channel bed. The Contractor shall place the washed gravel in the spaces between the rocks. Care shall be taken not to completely cover the rock. Should the underlying rock be completely obscured by the washed gravel, then the excess washed gravel shall be removed so as to expose the tops of the rocks.

Measurement for payment shall be on the basis of the area of washed gravel treated channel bed, measured in square metres rounded to the nearest whole number.

Payment at the contract price for washed gravel for channel bed shall be compensation in full for all labour, materials and use of equipment to supply and place the washed gravel described.

402.11 STREAM ROCKS

Stream rocks are sometimes used in streams to assist fish passage by providing places of slower current behind the rocks, so that fish can rest while migrating upstream.

Should stream rocks be required, they shall be placed individually, or in clusters, as directed by the Owner's Representative. The stream rocks shall be placed prior to the placement of small shot rock and washed gravel.

Stream rocks shall vary from 300 millimetres in diameter to a larger boulder.

Measurement for payment shall be by the number of individual stream rocks placed as required.

Payment at the contract price for Stream Rocks shall be compensation in full for all labour, materials and use of equipment to supply the stream rocks and place them as required.

402.12 PROVISION OF TREES AND SHRUBS

The planting of trees and shrubs may sometimes be required in order to provide cover for fish.

Trees and shrubs shall be of the species and sizes specified.

Transplanting shall not take place during the growing season (June-September). However, should the trees or shrubs be growing in flower pots, then these may be transplanted at any time if care is taken not to disturb the roots when removing the pot.

The most satisfactory transplanting results are often obtained using native trees or shrubs of height less then 1.2 metres.

The trees and shrubs shall be planted at the locations designated by the Owner's Representative.

Trees and shrubs of height 1.2 metres or less, shall be planted in at least 0.5 cubic metres of topsoil. The Contractor shall excavate a hole of the required size to take the topsoil. The excavated material shall be disposed of. The hole shall be half filled with lightly tamped topsoil. A hand full of bone meal shall be sprinkled over the topsoil near the roots. The tree or shrub shall be planted and the topsoil lightly tamped.

The planted tree or shrub shall be maintained by the Contractor including frequent watering that is to the satisfaction of the Owner's Representative. The Contractor shall provide a one year warranty for all plantings.

Measurement for payment shall be by the number of individual trees of the specified species and size planted.

Payment at the contract price for a tree or shrub of the specified size shall be compensation in full for all labour, materials and use of equipment to: excavate the required hole for the tree or shrub roots, dispose of the excavated material, supply and place topsoil, supply and place bone meal, and supply and plant the required tree or shrub.

402.12 SODDING CHANNEL SIDES

Should all or part of the channel sides and adjacent sides require sodding, then this work shall be carried out and paid for in accordance with Section 633.

402.13 HYDROSEEDING NEAR CHANNEL

Should hydroseeding be required at or near the stream relocation, then the work shall be carried out and paid for in accordance with the provisions of Section 632 and Section 635. Should soil for hydroseeding be required also, then it shall be provided and paid for in accordance with Section 634.

SECTION 403

EXCAVATION FOR FOUNDATION

INDEX

403.01 SCOPE

This work shall include labour, equipment and materials required to carry out excavation such as that required to obtain a foundation for such structures as bin-walls, culverts, footings, and gabions, and shall include hauling up to 1 kilometre, handling and incorporation of all suitable materials into fill construction in accordance with Section 204, and shall include the hauling up to 1 kilometre, and handling of the unsuitable materials and the trimming of such unsuitable materials along embankment slopes or elsewhere, all to the satisfaction of the Owner's Representative.

The Work shall also include excavation required prior to disposal or salvage of culvert or pipe.

The Work shall not include the excavation of those materials which the Contractor had previously placed, as their own choice as a temporary measure, and is required to excavate to facilitate the placing of, for example, select granulars. Any such excavation of materials which were placed as a temporary measure by choice of the Contractor, shall be at the Contractor's expense.

Where the quantity of excavation exceeds that required in the backfilling operation or to construct the fills, and if acceptable to the Owner's Representative, the surplus material shall be used to widen the fills, otherwise the Contractor shall dispose of the excess material to the satisfaction of the Owner's Representative. Any excavated material deemed unsuitable by the Owner's Representative shall be removed and disposed of by the Contractor at their expense.

403.02 ENVIRONMENTAL AND SAFETY REQUIREMENTS

The Contractor shall be aware of Division 8. Where unwatering is required, it shall be carried out as specified in Section 180.

The Contractor is advised that all excavation work shall be in accordance with the requirements of Section 190.

403.03 EXCAVATION FOR FOUNDATION

The Contractor shall excavate along the lines, to the width and to the grade required by the Owner's Representative.

403.03.01 Excavation for Foundation for Culverts Installed in All Places Other than Across Existing Roads

In the particular case of excavation for foundation for culverts installed in all places except across existing roads, the Contractor will normally be required to excavate for a width equal to the nominal diameter of the pipe, or the nominal span of the arch in the case of pipe arches, plus a distance of 300 millimetres on each side of the culvert, unless required otherwise by the Owner's Representative. The depth of the excavation shall be as shown on Form 1236, Form 1231, or Form 1232, as appropriate, or as directed by the Owner's Representative.

Excavation beyond the limits as described above shall be considered incidental to the Work.

403.03.02 Excavation for Foundation for Culverts Installed Across an Existing Road in a Low Fill

In the particular case of excavation for foundation for culverts installed across an existing road where the excavation is 1.22 metres deep, or less, the Contractor will be required to excavate for a width equal to the nominal diameter of the pipe, plus 0.3 metres on each side.

The depth of excavation shall be as shown on Form 1236, or as directed by the Owner's Representative.

Excavation beyond the limits as described above, shall be considered incidental to the Work.

403.03.03 Excavation for Foundation for Culverts Installed Across an Existing Road in a High Fill

In the particular case of excavation for foundation for culverts installed across an existing road where the excavation is deeper than 1.22 metres, the Contractor will be required to excavate for a width at the bottom of the trench, equal to the nominal diameter of the pipe, plus 0.3 metres on each side. However, at the top of the trench, the width shall be equal to the bottom width plus two times the depth of the trench.

For culverts where the depth of excavation is greater than 5.0 metres, calculated nominal excavation volumes will include the provision of a bench of nominal width 4.0 metres. The bench is intended to assist in the operation of removing the old culvert and installing the new one. The location of the bench will be such that there will be 5.0 metres from the

bottom of the culvert to the bench or another configuration that is to the satisfaction of the Owner's Representative.

The depth of excavation shall be as shown on Form 1236, Form 1231, Form 1232, or Form 1226, as appropriate, or as directed by the Owner's Representative. Excavation beyond the limits as described above, shall be considered incidental to the Work.

403.03.04 Excavation for Foundation for Gabions

In the case of excavation for foundations for gabions, the excavation pay lines shall be the length of the footing plus 300 millimetres on each end times the width of the footing plus 300 millimetres on each side times the depth between original ground line and foundation elevation or to the satisfaction of the Owner's Representative.

Excavation beyond the limits as described above shall be considered incidental to the Work.

403.03.05 Excavation for Foundation for Footings

In the case of excavation for concrete footings for structural plate arches, the excavation pay lines shall be the length of the footing plus 300 millimetres on each end times the width of the footing plus 300 millimetres on each side times the depth between original ground line and foundation elevation or to the satisfaction of the Owner's Representative. All excavation in addition to the above will be considered incidental to the Work.

When a footing is to rest on an excavated surface other than rock, special care shall be taken not to disturb the bottom of the excavation. In soft or wet conditions, the final removal of material to foundation level shall not be made until the Contractor is ready to proceed with the construction of the footing. When material at the founding elevation is Other Material and has been over excavated, the elevation shall be re-established by replacing with suitable material and compacting it to the bearing capacity of the original material to the satisfaction of the Owner's Representative. When the founding material is Solid Rock and has been over excavated, the foundation elevation shall be re-established to the original elevation with mass concrete. First, all loose and compressible material shall be removed from the excavation to the satisfaction of the Owner's Representative. Next, concrete shall be placed to the foundation elevation and shall fill the entire volume of the over excavation. Concrete shall be of a quality compatible with that used in the footing. No compensation will be provided for the cost of remedial measures required by the Owner's Representative as a result of over excavation by the Contractor.

403.03.06 Excavation for Foundation for Bin-Type Retaining Wall

In the case of excavation for bin-type retaining wall, the excavation lines shall be the length of the structure plus 1.0 metre on each end times the width of the structure plus 1.0 metre on each side times the actual depth from original ground to the base elevation or 200 millimetres below the base elevation where an unyielding or rock foundation exists. When the foundation is soft or has non-uniform bearing capacity, the lines for the excavation shall be as directed by Owner's Representative.

Excavation beyond the limits as described above shall be considered incidental to the Work.

403.03.07 Excavation for Foundation for Welded Wire Retaining Wall

In the case of excavation for welded wire retaining wall, the excavation lines shall be the length of the structure plus 0.3 metres on each end times the width of the structure plus 0.3 metres on each side times the actual depth from original ground to the base elevation or 200 millimetres below the base elevation where an unyielding or rock foundation exists. When the foundation is soft or has non-uniform bearing capacity, the lines for the excavation shall be as directed by the Owner's Representative.

Excavation beyond the limits as described above shall be considered incidental to the Work.

403.03.08 Backfill Material

Materials excavated as excavation for foundations will be used for backfill if the material is deemed suitable by the Owner's Representative.

If there should be insufficient backfill material available from the excavations, where possible the Owner's Representative will direct that material from a cut or from a borrow area will be used to complete the backfilling.

Should additional backfill materials be required to complete backfilling, then, these materials shall be paid for in accordance with Section 204, 206 or Section 207 as appropriate, but the additional requirements for backfilling as stipulated in this specification shall be considered compensated for in the contract price in Excavation for Foundation.

Frozen materials shall not be acceptable as backfill material.

403.04 CLASSIFICATION

Excavated materials will be classified as either "Solid Rock" or "Other Material" in accordance with Section 205.

403.05 MEASUREMENT FOR PAYMENT

Volumes of all classes of excavation described in Section 403.04 will be measured in excavation and computed in cubic metres rounded to the nearest whole number.

During excavation operations whenever the character of material changes from one type to another, as classified in Section 205, the Contractor shall strip the area, within the limits, of all overlying material and notify the Owner's Representative in order that proper measurements or cross sections may be made. No allowance will be made for material excavated before such measurements or cross sections have been made.

For boulders present in Other Material; the three maximum rectilinear dimensions of boulders, actually excavated, will be measured and the volume of each so determined. Volumes of the boulders which are equal to, or greater than, 0.5 cubic metres will be included for payment as Excavation for Foundation Solid Rock.

Where excavation for foundation is carried out during existing pipe removal operations, the cross-sectional area of the pipe to be removed shall be determined, and deducted for excavation end areas used in volume of excavation determinations.

403.05.01 Measurement for Payment for Excavation for Foundation for Culverts Installed in All Places Other than Across Existing Roads

Measurement for payment for Excavation for Foundation for culverts installed in all places other than across existing roads shall be by means of the nominal volume of excavation.

The quantity to be measured shall be the number of cubic metres of excavated material as shown between the position of the ground lines as cross sectioned after grubbing operations have been completed (or when excavation for foundation is to be carried out in a cut, after grading of cut or excavation of muskeg or bog operations have been completed, as appropriate), and the completed and accepted excavation lines. Material excavated outside of the required limits will not be included in measurement for payment. Nominal volume of excavation shall be computed by an adaption of the Average End Area method of volume computation, in which end areas are calculated as the product of the required depth of excavation, times the nominal width of excavation.

The nominal width of excavation shall be taken as either: 1.0 metre or the nominal diameter of the culvert plus 0.6 metres, whichever is greater.

403.05.02 Measurement for Payment for Excavation for Foundation for Culverts Installed Across an Existing Road in a Low Fill

Measurement for payment for Excavation for Foundation for culverts installed across an existing road where all the excavation is 1.22 metres deep, or less, shall be by means of the nominal volume of excavation.

Nominal volume of excavation shall be computed by an adaption of the Average End Area method of volume computation, in which end areas are calculated as the product of the required nominal depth of excavation, times the nominal width of excavation. The nominal depth of excavation shall be defined as the depth of the excavation on the centerline of the culvert at original ground to the bottom of the trench as specified by the Owner's Representative. The nominal width of excavation shall be taken as either: 1.0 metre or the nominal diameter of the culvert plus 0.6 metres, whichever is greater.

403.05.03 Measurement for Payment for Excavation for Foundation for Culverts Installed Across an Existing Road in a High Fill

Measurement for payment for Excavation for Foundation for culverts installed across an existing road where the excavation is more than 1.22 metre depth, shall be by means of the nominal volume of excavation.

Nominal volume of excavation shall be computed by an adaption of the Average End Area method of volume computation, in which the end areas used in the calculations are nominal end areas. For each culvert, the volume shall be calculated using the excavation nominal end area: at the inlet, at the edge of the road shoulder, at the road center line, at the edge of the other shoulder, at the outlet and at any other significant inflection point within the cross-section of the culvert. These individual nominal end areas shall each be calculated in accordance with the typical cross section shown on Form 1226.

403.05.04 Measurement for Payment for Excavation for Foundation for Items Other than Culverts

Measurements shall be of the actual amount of material moved from within the limits required by the Owner's Representative.

The quantity to be measured shall be the number of cubic metres of excavated material as shown between the position of the ground lines as cross sectioned after grubbing operations have been completed (or when excavation for foundation is to be carried out

in a cut, after grading of cut or excavation of muskeg or bog operations have been completed as the case may be), and the completed and accepted excavation lines. Material excavated outside of the required limits will not be included in measurement for payment. The volume of the excavation to be computed by the average end area method of computation or as wedges or pyramids, as the case may be, when terminating at grade points.

403.06 BASIS OF PAYMENT

Payment shall be at the Contract Unit Price per cubic metre for Excavation for Foundation, Solid Rock or Other Material, as appropriate, hauled 1 kilometre or under and the backfilling of the same in accordance with the plans or to the satisfaction of the Owner's Representative. Such payment shall be full compensation for all work herein described together with the labour, materials, and equipment use required for excavating, handling, hauling up to 1 kilometre, placing, and compacting in a fill as described in Section 204 or stockpiling and reuse of the materials excavated as excavation for foundations for backfill of the excavation if the material is deemed suitable by the Owner's Representative or disposing over slopes, removing and disposing, or otherwise directed by the Owner's Representative.

Where the Owner's Representative requires that Excavation for Foundation material be hauled in excess of 1 kilometre, additional payment for overhaul will be made in accordance with Section 215.

SECTION 404

TRENCHING AND EXCAVATION FOR CATCH BASINS AND STORM SEWERS

INDEX

404.01 SCOPE

This specification covers the requirements for excavation for catch basins, and trenching for sanitary sewers, storm sewers, and sub-drains together with the requirements for backfilling and compacting material in trenches after the removal of pipe or after the placing of pipe and bedding. Also included is the hauling up to 1 kilometre, of surplus or unsuitable excavation and trenching materials, the handling, and incorporation of suitable surplus excavation and trenching materials into fill construction in accordance with Section 204 and the handling of unsuitable materials, the placing, and trimming of such unsuitable materials along embankment slopes or elsewhere, to the satisfaction of the Owner's Representative.

The requirements for placing bedding for storm sewers, sub-drains, and catch basins are covered separately under Section 410.

The Contractor is advised that all work shall be completed in accordance with the requirements of Section 190.

404.02 CLASSIFICATION OF EXCAVATION AND TRENCHING MATERIALS

Materials excavated under this heading will be classified as either "Solid Rock" or "Other Material", in accordance with Section 205.

404.03 EXCAVATION AND TRENCHING

The use of mechanical excavation and trenching equipment will be permitted except where, in the opinion of the Owner's Representative, their use will cause damage to structures below ground. The Contractor shall proceed with caution in the excavation and trenching work so that the exact location of all buried pipes, services, cables, and underground structures, both known and unknown may be determined. The Contractor shall be responsible for the repair of such pipes, services, cables, and structures when broken or otherwise damaged.

All excavation and trenching material shall be piled in a manner that will not endanger the work and that will avoid obstructing sidewalks and driveways. Gutters shall be kept clear or other satisfactory provision made for street drainage, and natural water courses shall not be obstructed.

Should the Contractor excavate deeper than required, then excavation shall be refilled to the required excavation grade with approved material and compacted to at least 95% of Standard Proctor Density (ASTM D698), all at the Contractor's expense.

404.03.01 Excavation for Catch Basins

Excavations for catch basins shall be carried out at those locations and to the grades as staked by the Owner's Representative. The size of the excavation shall be such as to facilitate the installation of the catch basin structure in accordance with the requirements of Section 470.

Where the material at excavation grade proves unstable then the excavation bottom shall be sub-excavated to such depth and replaced with such material and compacted to the satisfaction of the Owner's Representative.

Should the excavation require blasting, the mouth of any pipe, any portion of pipe not backfilled, and any catch basins, shall be adequately protected. No blasting shall be performed within 6 metres of a pipe or catch basin previously placed.

404.03.02 Trenching for Sanitary Sewers, Storm Sewers and Sub-Drains

The trench shall be excavated true to the line staked by the Owner's Representative.

The trench shall be excavated so as to facilitate the installation of the pipe in accordance with Form 1235.

In Other Material, when trenching for a corrugated steel pipe sewer, the excavation shall be to the proposed invert elevations and be graded so as to provide a uniformly firm bed for the pipe. However, when trenching for a plastic pipe in Other Material, the excavation shall be to a depth of 150 millimetres below the proposed invert elevations so as to make room for select bedding under the pipe.

In Solid Rock, regardless of whether corrugated steel or plastic pipe is to be used, the excavation shall be to a depth of 150 millimetres below the proposed invert elevations so as to make room for select bedding under the pipe.

The width of the trench shall be such so as to facilitate the installation of the pipes and the placing of bedding in accordance with Section 420, and Section 410 respectively.

The trench shall be excavated beginning at the lower end and proceeding towards the upper end.

Not more than 50 metres of trench shall be opened at any place in advance of the completed pipe line unless permission of the Owner's Representative is obtained and for such distances as then specified.

The Contractor is responsible for the construction of the trench to the line and grade provided by the Owner's Representative. Should the quality of work not be maintained, the Owner's Representative shall direct the Contractor to rectify the Work as necessary. No additional costs shall be made for this corrective action.

Where the material at excavation grade proves unstable then the excavation bottom shall be sub-excavated to such depth and replaced with such material and compacted to the satisfaction of the Owner's Representative.

Should the excavation or trench require blasting, the mouth of any pipe, any portion of pipe not backfilled and any catch basins shall be adequately protected. No blasting shall be performed within 6 metres of a pipe or catch basin previously placed.

404.04 SHEATHING AND SHORING

Where, due to the nature of the work, the Contractor sheathes, shores, or braces the excavation and/or trenches then such sheathing, shoring, or bracing shall be supplied, installed, maintained, removed or left in place as part of the work, all at the Contractor's expense.

All works behind the sheathing shall be filled with native backfill or Other Material, to the satisfaction of the Owner’s Representative, and compacted as the sheathing is placed.

The Contractor has the option of removing the sheathing before backfilling, or leaving it in place, however, no sheathing shall be left in place within 1 metre of subgrade.

In trench work, sheathing shall not be removed until all required bedding material has been placed and compacted.

404.05 PROVISION FOR TRAFFIC AND PEDESTRIANS

The Contractor shall provide, place, and maintain such barricades, construction signs, delineation devices and guards as are required to protect persons from injury and to avoid property damage during the progress of the Work.

The Contractor shall at all times provide access to adjacent properties during the Work. Such required bridging shall be provided, placed, and maintained by the Contractor.

Should the Contractor have to divert traffic over channelling, curbs and sidewalks, etc., they must protect the same from damage and any such damage must be made good at their expense

In the event of a stoppage of work, excavations shall not be left open for a period exceeding two weeks. The Contractor shall refill such excavations and shall provide the required protection for pipes and manholes already installed, to the satisfaction of the Owner’s Representative.

Re-excavation shall be at the Contractor's expense, unless the stoppage was beyond their control.

404.06 BACKFILL MATERIAL

Materials excavated from trenches, and as excavation for catch basins will be used for trench backfill if the material is deemed suitable by the Owner's Representative.

If there should be insufficient backfill material available from the excavations, where possible then the Owner's Representative will direct that material from a cut or from a borrow area will be used to complete the backfilling.

Should additional backfill materials be required to complete backfilling, then, these materials shall be paid for in accordance with Section 204, 206 or Section 207 as appropriate, but the additional requirements for backfilling as stipulated in this specification shall be considered compensated for in the contract price.

Frozen materials shall not be acceptable as backfill material.

404.07 BACKFILLING AND COMPACTION

No backfill material shall be placed until any required pipes and bedding have been installed to the satisfaction of the Owner's Representative.

Backfill material shall be carefully placed so as not to cause damage or movement to any pipes in the trench.

Backfill and cover material shall be placed in layers not exceeding 200 millimetres in thickness loose measurement. Each layer shall then be compacted to the required compaction before a further layer is placed.

Backfill consisting of Other Material or Other Material Borrow shall be compacted to a minimum of 95% of the Standard Proctor Density (ASTM D698).

In rock backfill material where Standard Proctor tests can not be carried out, compaction shall be continued until there is no visible movement of fill under a vibrating vibratory compactor. The vibratory roller length shall be not less than 1.5 metres.

The Contractor shall remove all surplus or unsuitable trench and catch basin excavation material.

Surplus excavation materials that are suitable shall be incorporated into fill construction, as directed by the Owner's Representative and in accordance with the requirements of Section 204.

Unsuitable excavation material, or surplus excavation material for which no use can be found, shall be placed and trimmed along embankment slopes or in waste areas, as directed by the Owner's Representative.

The Contractor shall be liable for any damages arising from default or neglect in backfilling operations.

404.08 MEASUREMENT FOR PAYMENT

Measurement for payment will be by means of nominal volume of trench excavation, plus nominal volume of catch basin excavation, being made up of either excavated Solid Rock or excavated Other Material, as classified in Section 404.02.

The nominal volume of excavation shall be measured in cubic metres rounded to the nearest whole number.

During excavation operations whenever the character of the material changes from Other Material to Solid Rock, then the Contractor shall excavate the overlying Other Material, and notify the Owner's Representative in order that proper measurements of depth may be made. No allowance will be made for material excavated before such measurements have been completed.

For boulders present in Other Material; the three maximum rectilinear dimensions of boulders, actually excavated, will be measured and the volume of each so determined. Volumes of the boulders which are equal to, or greater than, 0.5 cubic metres will be included for payment as Solid Rock trenching and/or excavation as the case may be.
Excavation lower than the required grade or beyond the width pay limit, or as a result of side slips caused by whatever reason, shall not be included in measurement for payment.

404.08.01 Measurement for Payment in Excavation for Catch Basins

Nominal volume of catch basin excavation shall be defined as the volume given by the product of: width given by outside width of the catch basin plus 0.6 metres, times breadth given by outside breadth of the catch basin plus 0.6 metres, times the depth of the excavation measured vertically from the ground surface (after "Excavation of Cut" operations have been completed) to the accepted excavation grade.

404.08.02 Measurement for Payment in Trenching for Sanitary Sewers, Storm Sewers and Sub-Drains.

Nominal volume of sewer and sub-drain trench excavation material shall be computed by an adaption of the Average End Area method of computation, in which end areas are

taken to be the product of; the depth of the excavation measured vertically in metres from the ground surface (After "Excavation of Cut" operations have been completed) to the accepted excavation grade, times the nominal width of excavation.

The nominal width of excavation shall be taken to be 1.0 metre, or the nominal pipe diameter in metres plus 0.6 metres, whichever is greater.

Lengths used in the average end area method of volume computation shall not include those distances of width of catch basin plus 0.6 metres, included as part of the calculation of nominal volume of catch basin excavation.

Where perforated pipe is to be placed in the same trench as a storm sewer, then the width of excavation to be used in the nominal volume of trench excavation computation shall be only the storm sewer nominal diameter in metres plus 0.6 metres.

404.09 BASIS OF PAYMENT

404.09.01 Basis of Payment in Excavation for Catch Basins

Payment shall be at the contract price in Excavation for Catch Basins (a) Solid Rock or (b) Other Material, as the case may be, hauled 1 kilometre or under. Such payment shall be full compensation for all work herein described together with the labour, materials and equipment use required for excavation, handling, unwatering, sheathing and shoring; provision for accommodation of traffic and pedestrians; placing and compacting backfill; for the hauling up to the 1km freehaul limit, placing, compaction, and trimming of excess excavated materials placed within and the removal and disposal of excess excavated material placed outside the contract limits; and for all repair work required under Section 404.03 and Section 404.05.

The Contractor shall be deemed to have allowed for in their price for excavation, any excavation by hand, where the proximity of other structures or other considerations render this necessary.

Should additional backfill materials be required to complete backfilling, then, these materials shall be paid for in accordance with Section 204, Section 206 or Section 207 as appropriate, but the additional requirements for backfilling as stipulated in this specification shall be considered compensated for in the contract price.

Where the Owner’s Representative requires that excavation or borrow materials be hauled in excess of 1 kilometre, additional payment for overhaul will be made in accordance with Section 215.

404.09.02 Basis of Payment in Trenching

Payment shall be at the contract price in Trenching (a) Solid Rock or (b) Other Material, as the case may be, hauled 1 kilometre or under. The basis of payment for trenching shall include trenching for sanitary sewers, storm sewers, and sub-drains without specification to the particular kind.

Such payment shall be full compensation for all work herein described together with the labour, materials and equipment use required for trenching, handling, unwatering, sheathing and shoring; provision for accommodation of traffic and pedestrians; placing and compacting backfill; for the hauling up to 1 kilometre freehaul limit; placing, compaction, and trimming of excess excavated materials placed within and the removal and disposal of excess excavated material placed outside the contract limits; and for all repair work required under Section 404.03 and Section 404.05 .

The Contractor shall be deemed to have allowed for in their price for excavation, any excavation by hand, where the proximity of other structures or other considerations render this necessary.

Should additional backfill materials be required to complete backfilling, then, these materials shall be paid for in accordance with Section 204, Section 206 or Section 207 as appropriate, but the additional requirements for backfilling as stipulated in this specification shall be considered compensated for in the contract price.

Where the Owner's Representative requires excavation or borrow materials be hauled in excess of 1 kilometre, additional payment for overhaul will be made in accordance with Section 215.

404.09.03 Basis of Payment in Trenching and Excavation for Catch Basins

Payment shall be at the contract price in Trenching and Excavation for Catch Basins (a) Solid Rock or (b) Other Material, as the case may be, hauled 1 kilometre or under. The basis of payment in trenching and excavation for catch basins shall include both trenching and excavation for catch basins without specification to the particular kind.

Such payment shall be full compensation for all work herein described together with the labour, materials, and equipment use required for both trenching and excavation, handling, unwatering, sheathing and shoring; provision for accommodation of traffic and pedestrians; placing and compacting backfill; for the hauling up to the 1km freehaul limit, placing, compaction, and trimming of excess excavated materials placed within and the removal and disposal of excess excavated material placed outside the contract limits; and for all repair work required under Section 404.03 and Section 404.05 .

The Contractor shall be deemed to have allowed for in their price for excavation, any excavation by hand, where the proximity of other structures or other considerations render this necessary.

Should additional backfill materials be required to complete backfilling, then, these materials shall be paid for in accordance with Section 204, Section 206 or Section 207 as appropriate, but the additional requirements for backfilling as stipulated in this specification shall be considered compensated for in the contract price.

Where the Owner's Representative requires that excavation or borrow materials be hauled in excess of 1 kilometre, additional payment for overhaul will be made in accordance with Section 215.

SECTION 405

TEMPORARY DIVERSION OF STREAMS

INDEX

405.01 SCOPE

This specification covers the requirements for the temporary diversion of streams.

405.02 ENVIRONMENTAL REQUIREMENTS

Contractors are reminded that the requirements of Division 8 apply to all work associated with this specification.

405.03 CUTTING TREES AND BRUSH FOR TEMPORARY DIVERSION

The proposed temporary diversion site shall be cut to the limits designated by the Owner's Representative. This work shall be carried out and paid for in accordance with the provisions of Section 202.

405.04 GRUBBING FOR TEMPORARY DIVERSION

The Contractor shall only grub within the limits designated by the Owner's Representative.

In order to minimize siltation into the temporary stream diversion, grubbing shall initially be confined to the limits of from one proposed stream bank to the other, leaving wide ungrubbed strips adjacent to each bank. After the temporary diversion has been abandoned the balance of the required grubbing may be carried out.

The grubbing shall be carried out and paid for in accordance with Section 203.

405.05 PREPARATION OF CHANNEL FOR STREAM DIVERSION

The channel shall be excavated to the lines, cross sections and grades designated by the Owner's Representative. The channel shall be excavated in the dry. The Contractor shall carry out the work in such a way so as to cause a minimum of disturbance and siltation to the water course. The channel shall be lined with polyethylene sheeting of suitable strength.

In order to minimize siltation, excavated material shall not be placed adjacent to the banks.

The stream shall not be diverted until the channel has been prepared to the satisfaction of the Owner's Representative.

When the diversion is made, the old channel shall be closed off with sand bags, or such other non-silting, non erodible and impervious material which is satisfactory to the Owner's Representative.

Care shall be taken to prevent fish being stranded in closed off diversions.

The Contractor shall minimize the crossing of water courses by heavy equipment. The same crossing place shall be used for such crossings as are unavoidable. At the completion of operations, the crossing place shall be put back to its original condition.

405.06 CLEAN UP REDUNDANT CHANNEL

After the stream has been diverted to the new culvert or water course, and the temporary diversion is no longer required, then that portion of the temporary diversion that will not be covered by fill, shall be graded and trimmed to sightly proportions and stabilized to the satisfaction of the Owner's Representative, including sodding and/or hydroseeding of previously undisturbed areas.

405.07 MEASUREMENT FOR PAYMENT

Measurement for payment shall be by the number of cubic metres of excavated material as shown between the position of the ground lines as cross sectioned after grubbing operations have been completed, and the completed and accepted excavation lines. Material excavated outside of the required limits will not be included in measurement for payment. The volume of the excavation to be computed by the average end area method

of computation or as wedges or pyramids, as the case may be, when terminating at grade points.

During excavation operations whenever the character of material changes from Other Material to Solid Rock, then the Contractor shall strip the area, within the limits, of all overlying material, and notify the Owner's Representative in order that proper measurements for cross sections may be made. No allowance will be made for material excavated before such measurements or cross sections have been made.

For boulders present in Other Material; the three maximum rectilinear dimensions of boulders, actually excavated, will be measured and the volume of each so determined. Volumes of the boulders which are equal to, or greater than, 0.5 cubic metres will be included for payment as rock.

405.08 BASIS OF PAYMENT

Payment shall be at the contract price per cubic metre for either Excavation for Temporary Diversion of Streams, Solid Rock, hauled 1 kilometre or under; or Temporary Diversion of Streams, Other Material, hauled 1 kilometre or under, as the case may be. Such payment shall be compensation in full for all labour, materials and use of equipment to: excavate the material from within the required horizontal alignment, cross section and profile, load and transport the material up to the 1 kilometre freehaul limit and place and compact the material in a fill, supply and place such sand bags or other items necessary to divert the water to the temporary diversion, divert the stream to the diversion, divert the stream to the new culvert or water course after the permanent features have been put in place, and to grade and trim the temporary diversion channel to sightly proportions after it is no longer required including and sodding or hydroseeding of previously undisturbed areas.

Where the Owner's Representative requires that excavated materials be hauled in excess of the 1 kilometre freehaul limit before being placed, additional payment for overhaul will be made in accordance with Section 215.

Should the contract not include quantities for "Excavation for Temporary Diversion of Streams, Solid Rock", then payment for that quantity shall be at the contract price for "Ditching Solid Rock".

Likewise, should the contract not include quantities for "Excavation for Temporary Diversion of Streams, Other Material", then payment for that quantity shall be at the contract price for "Ditching Other Material".

SECTION 410

SELECT BEDDING FOR STORM SEWERS, SUB-DRAINS AND CATCH BASINS

INDEX

410.01 SCOPE

This work shall include labour, materials, and equipment use required to provide, place and compact select bedding for storm sewers, sub-drains, and the sides of catch basins.

410.02 MATERIALS

Select bedding material shall be crushed stone or pit run gravel and shall have the gradation of Granular "B" as set forth in Section 315.

410.03 PLACING OF BEDDING

Prior to any placing of bedding, material from cave-ins, accumulations of water and muck and all other objectionable matters shall be removed, damaged sections repaired or removed and replaced, and any other repair or attention required for a workmanlike job shall be performed.

No placing of select bedding shall be carried out until the works to be covered by bedding have been inspected and passed for backfilling by the Owner’s Representative.

Chutes or other proper means shall be used to prevent segregation of materials or displacement of structures or pipes. Improper dumping of select bedding material will not be permitted.

Select bedding material for pipes and catch basins shall be placed in layers not exceeding 200 millimetres in thickness loose measurement. Each layer shall then be compacted to the density specified before a further layer is placed.

Select bedding for storm sewers and sub-drains shall be placed as shown in Form 1235.

410.03.01 Placing of Under Bedding in Trenches

In the case of rock bottomed trenches, select bedding shall be placed in the bottom of the trench to provide under bedding for the pipe.

In the case of Other Material bottomed trenches, no select bedding is required for corrugated steel pipe. However, if plastic pipes are to be used then select bedding shall be placed in the bottom of the Other Material bottomed trench to provide under bedding for the plastic pipe.

Under bedding shall be shaped to conform to the underside of the pipe and be graded to conform to the required grade for the pipe.

410.03.02 Placing of Bedding in Each Side and Over Pipe

When placing select bedding over pipes, bedding operations shall be kept back at least 3 metres from the advanced end of the pipe line, except for the completion of any section or at the termination of a day's work. Uncovered pipe, left overnight, shall be backfilled as soon as possible to the end of the pipe without covering it. The trench shall be filled with select bedding material to a height of at least 300 millimetres above the top of the pipe, or when more than one pipe is laid in the trench, to a height of at least 300 millimetres above the top of the highest pipe.

Select bedding material placed around a pipe shall be maintained at equal levels on each side of the pipe at all times, so that the intended alignment of the pipe be achieved.

410.03.03 Placing of Bedding for Catch Basins

The excavation surrounding the exterior of the catch basin shall be filled with compacted select bedding material up to subgrade elevation. Select backfill to be placed to a minimum of 300 millimetres on all sides. Care shall be exercised in compacting the material to assure that the structure is not disturbed.

410.04 COMPACTION

Each layer of select bedding material shall be compacted to at least 95% of Standard Proctor Density (ASTM D698).

410.05 MEASUREMENT FOR PAYMENT

410.05.01 Measurement for Payment for Pipe Bedding

Measurement for payment for select bedding when used to cover storm sewers and sub-drains, will be by means of the net nominal volume of select bedding, measured in cubic metres rounded to the nearest whole number.

Net nominal volume of select bedding for storm sewers and sub-drains being defined as the gross nominal volume of select bedding material, less the nominal volume of the pipe, or pipes, treated with select bedding.

In trenches where under bedding is not required, such as Other Material bottomed trench in which a corrugated steel pipe is to be placed, then gross nominal volume of select bedding shall be defined as the volume of a rectangular prism calculated as the product of: width equal to the nominal diameter of the pipe in metres plus 0.6 metres (total width minimum = 1.0 metre), depth equal to the pipe nominal diameter in metres plus 0.3 metres, and the length in metres of pipe treated with select bedding.

In trenches where under bedding is not required and where a perforated pipe is placed in a trench alongside of a storm sewer, then the gross nominal volume of select bedding shall be calculated as the product of: width equal to only the storm sewer nominal diameter in metres plus 0.6 metres (minimum = 1.0 metre), depth equal to the storm sewer nominal diameter in metres plus 0.3 metres, and the length in metres of the storm sewer pipe treated with select bedding.

In trenches where under bedding is required, such as a trench with a rock bottom or any kind of trench in which a plastic pipe is to be placed, then gross nominal volume of select bedding shall be defined as the volume of a rectangular prism calculated as the product of: width equal to the nominal diameter of the pipe in metres plus 0.6 metres minimum = 1.0 metre), depth equal to the pipe nominal diameter in metres plus 0.45 metres, and the length in metres of pipe treated with select bedding.

In trenches where under bedding is required and where a perforated pipe is placed in a trench alongside of a storm sewer, then the gross nominal volume of select bedding shall be calculated as the product of: width equal to only the storm sewer nominal diameter in

metres plus 0.6 metres (minimum = 1.0 metre), depth equal to the storm sewer nominal diameter in metres plus 0.45 metres, and the length in metres of the storm sewer pipe treated with select bedding.

Nominal volume of each treated pipe being defined as the volume calculated from the manufacturer's nominal pipe diameter and the length of pipe treated with select bedding material.

410.05.02 Measurement for Payment for Catch Basin Bedding

Measurement for payment for select bedding when used for providing bedding for the sides of catch basins will be by means of the nominal volume of select bedding, measured in cubic metres rounded to the nearest whole number.

Nominal volume of select bedding for catch basins shall be defined as the product of catch basin outside perimeter measured in metres plus 1.25 metres, times the measured height in metres between underside of catch basin and subgrade elevation, times a nominal thickness of 0.3 metres.

410.06 BASIS OF PAYMENT

Payment shall be at the contract unit price per cubic metre for select bedding for storm sewers, sub-drains and catch basins.

Such payment shall be full compensation for all work herein described together with the labour, materials, and equipment use required to: supply, haul, place and compact the select bedding material, together with any unwatering that may be required to carry out the work.

SECTION 411

SELECT BACKFILL FOR LONG SPAN STRUCTURAL PLATE STRUCTURES

INDEX

411.01 DESCRIPTION

This specification covers the requirements for the provision of select backfill and bedding for use with those long span structural plate structures (LSSPS) for which the Contractor is responsible for the design.

The long span structural plate structure shop drawings for the long span structure, which must be submitted to, reviewed and accepted by the Department, shall specify the select backfill envelope, gradation chart, electrochemical limits, compaction requirements and backfilling procedure.

411.02 SELECT BACKFILL AND MATERIAL TESTING

Backfill material in the engineered backfill zone shall be clean, well graded, granular material meeting the strength, gradation, compressibility and electrochemical requirements specified in the manufacturer's shop drawings.

Unless otherwise noted on the manufacturer's shop drawings, the engineered backfill envelope shall meet the requirements of the latest CAN/CSA-S6 design code.

All Long Span Structural Plate backfill shall be provided from a single source.

When the air temperature is below 0°C, no backfilling is allowed. Frozen granular backfill materials will not be permitted. No backfill material will be permitted to be placed directly on frozen substrate.

It shall be the Contractor's responsibility to carryout all required quality control testing. The Contractor shall use professional geotechnical engineering services and a qualified

testing firm licensed in Newfoundland and Labrador for all sampling and testing of the select backfill.

All backfill material testing shall be carried-out on a project specific basis. Material testing results obtained from an alternate project will not be accepted by the Department.

At least two weeks prior to start of construction the Contractor shall identify the source of materials to be used for the LSSPS select backfill and provide initial testing for the LSSPS backfill. This testing shall include both gradation and electrochemical testing as a minimum. A copy of these test results shall be provided to the Owner's Representative. The Contractor shall provide a letter of conformance from their third party geotechnical consultant stating that the material testing results are in compliance with this specification. In addition, the Contractor shall provide a letter of conformance from the LSSPS manufacturer/designer stating that the select backfill meets the electro-chemical and geotechnical requirements assumed in the design of the structure. All letters of conformance shall bear the stamp of a Professional Engineer licensed to practice in the Province of Newfoundland and Labrador.

Select backfill and select bedding material testing shall satisfy all of the following requirements:

1. ASTM D2487 - Group GW, SW, GP, GW-GM, or SW-SM
2. ASTM D6913 - Maximum 75mm particles size (Select Backfill)
   Maximum 25mm particles size (Select Bedding)
   Minimum Gravel Content 35% (particle size > 4.75mm)
   Less than 50% passing the 0.150mm sieve
   Less than 10% passing the 0.075mm sieve
3. ASTM D4318 - Plasticity index less than 6%
4. Uniformity Coefficient (Cu): Cu ≥ 4
5. Coefficient of Curvature (Cc): $1 \leq Cc \leq 3$
6. Angularity of non-crushed Materials, ASTM D2488: > 35% Angular/Sub-angular
7. Flat/Elongates, ASTM D-2488 or ASTM D4791: < 25%
8. Los Angeles Abrasion Loss, ASTM C131: < 40%

Magnesium sulphate Soundness Loss, AASHTO T104: < 30% after four cycles

No material testing requirements shall be waved.

As a minimum requirement, select backfill material must conform to the electro-chemical limits per AASHTO LRFD specifications, as detailed in Table 4 of Corrugated Steel Pipe

Institute's (CSPI) Technical Bulletin. The select backfill material shall be tested in accordance with AASHTO or ASTM standard methods and meet the following criteria:

ELECTRO-CHEMICAL PARAMETER	ELECTRO-CHEMICAL REQUIREMENT	TEST METHOD	
		AASHTO	ASTM
Chlorides (Cl^-)	< 100 ppm	T291	D512
Sulphates (SO_4^{2-})	< 200 ppm	T290	D516
Resistivity	> 3000 ohm-cm	T288	G57
pH	5 – 10	T289	D51
Max Organic Content	< 1%	T267	-

In addition to the initial gradation and electrochemical testing, the Contractor shall sample and test the backfill for conformance with the gradation requirements at least once for every 250 cubic metres of material placed.

The Contractor shall also provide a 20 kilogram representative sample of the backfill proposed for construction to the Owner's Representative for testing and approval two weeks prior to start of construction. The sample provided shall meet the geotechnical parameters as specified by the manufacturer.

All sampling shall be carried out in the presence of the Owner's Representative.

Additional gradation testing at the Contractor's expense may be required if based upon visual inspection in the field it is evident to the Owner's Representative that the gradation of the select backfill material has changed.

Gradation requirements will be strictly enforced and variances to coarser or less well graded material will not be accepted.

The Contractor shall also be responsible for testing to establish the Standard Proctor Maximum Dry Density (ASTM 698) of the approved backfill and will be responsible for having the compaction of each lift of backfill tested for conformance with the manufacturer's/designer's compaction requirements. All results shall be provided to the Owner's Representative as the work progresses.

Where conventional material testing is not possible the Contractor shall use professional engineering services licenced to practice in Newfoundland and Labrador to provide a visual inspection of each lift, ensuring proper compaction. The Contractor shall provide a letter of conformance from the third party engineering firm stating that the select backfill

meets the compaction requirements stipulated in this specification and by the manufacturer/designer.

There will be no payment for LSSPS installation until all initial testing results and letters of conformance from the Contractor's geotechnical consultant and LSSPS manufacturer/designer have been submitted to the Owner's Representative and deemed acceptable.

Timely submission of all required gradation and compaction testing results shall be provided to the Owner's Representative as the work progresses. The Contractor is advised that failure to provide testing results, or failure to meet the specified requirements, may result in the rejection of the select backfill material. Select backfill rejected by the Department as a result of not meeting the material requirements of manufacturer/designer, or the requirements of this specification, shall be carefully excavated and replaced in accordance with this specification, at the Contractor's expense.

The Contractor is advised that the Department may elect to carryout quality assurance work in relation to any aspect of this structure. No delay claims will be accepted as a result of this activity.

Where there are discrepancies between the Department's and manufacturer's/designer's specifications then the more stringent requirement shall govern.

411.03 BACKFILLING OPERATIONS

The Contractor shall notify the Owner's Representative a minimum of 7 days prior to the commencement of backfilling operations.

The Contractor shall use professional geotechnical engineering services licensed in Newfoundland and Labrador for backfilling supervision and monitoring. The Geotechnical Engineer or their designate must be on site to supervise and direct backfilling operations on a full time basis. Once backfilling is complete the geotechnical consultant shall provide a letter of conformity stating that that all backfilling operations have been completed in accordance with the manufacturer/designer requirements and the requirements of this specification. The recommended backfilling procedure provided in the shop drawings shall be adhered to.

Backfilling shall not commence until footings and any concrete headwalls and wingwalls have achieved at least 70% of the specified design strength at 28 days or cured for seven

days, whichever comes first. This requirement may be increased by the Engineer of Record for the concrete footings, wing walls and headwalls.

The backfill material shall be uniformly placed in compacted lifts on both sides of the structure, as directed by the backfill procedure on the shop drawings. The backfill lifts shall not exceed 250 millimetres in depth (before compaction) and shall be compacted to a minimum of 98% Standard Proctor Dry Density (ASTM D698) unless otherwise noted on the manufacturer's shop drawings. The difference in levels of the backfill on the two sides at any transverse section shall not exceed two compacted lift thickness and the maximum particle size of 75 millimetres within 300 millimetres of the structure.

Heavy equipment cannot be operated within 1000 millimetres of the structure. Fill within 1000 millimetres of the structure must be placed and compacted using light equipment or by hand.

Loads that exceed design loading are not permitted on the structure.

Live Load traffic is not permitted until the structure has been backfilled to the minimum design height of cover without prior approval from the Engineer of Record.

Backfill shall be carefully placed and compacted so that the correct shape of the structure is maintained. The Contractor shall monitor the shape of the structure during backfilling operations. Any deflection from the specified dimensions shall be within the tolerances noted on the manufacturer's shop drawings. If deflections exceed the permitted tolerances, then backfilling operations shall be ceased until a suitable procedure is developed and approved by the LSSPS manufacturer/designer. The manufacturer and Owner's Representative shall be notified in writing immediately of any deflections that are in excess of the permitted tolerances.

All structural plates which exhibit permanent deformation or strain for any reason shall be rejected by the Department and replaced at the Contractor's expense.

411.04 BASIS OF PAYMENT

The supply, transport, placement, geotechnical supervision, testing and compaction of select backfill and bedding material, meeting the manufacturer's/designer's requirements, and the requirements of this specification, shall be compensated for as part of the basis of payment for the design, supply and installation of the Long Span Structural Plate Structure, as per Section 426.

No separate payment will be made for select backfill or select bedding material.

SECTION 420

SUPPLY AND INSTALLATION OF PIPE FOR STORM SEWERS AND PERFORATED PIPE FOR SUB-DRAINAGE

INDEX

420.01 SCOPE

This specification covers the requirements for the supply and installation of factory fabricated pipes for storm sewers and perforated sub-drains.

The requirements for storm sewer or sub-drain trench excavation and backfilling, and the requirements for storm sewer or sub-drain bedding are covered separately under Section 404 and Section 410 respectively.

420.02 MATERIALS

Pipe shall consist of aluminized steel pipe type 2 or polymer laminated in accordance with the Corrugated Steel Pipe Institute (CSPI) Performance Guideline for Corrugated Steel Pipe Culverts (300 millimetres to 3600 millimetres in Diameter). However, contractors are advised that consideration will be given to proposals to substitute with corrugated polyethylene pipe for diameters of up to and including 600 millimetres. The pipe shall be of the type and size specified in the Unit Price Table.

The Contractor shall supply concrete to form plugs for the upstream ends of sub-drains. The concrete shall have a minimum compressive strength of 28 days of 20 MPa.

The Contractor shall supply the pipe, couplers, wyes, tees, adaptors, bends, nuts and bolts.

420.02.01 Aluminized & Polymer Laminated Steel Pipe Materials

Aluminized & polymer laminated corrugated steel pipe, couplers, wyes, tees, bends, adapters, nuts and bolts shall conform to the requirements of the most recent revisions of the following specifications: AASHTO M274 and M36, ASTM A760/A760, A762/A762M, ASTM A929/A929M and CSA G401.

The pipe shall have a wall thickness of at least that specified in the Unit Price Table. However, should the wall thickness not be specified, then the wall thickness shall be at least the corresponding thickness given in the following table for pipe of the size and type required.

PIPE DIAMETER	MINIMUM WALL THICKNESS
100 mm to 500 mm	1.6 mm for Any Corrugation
600 mm to 1200 mm	2.0 mm for Any Corrugation
1400 mm to 1800 mm	2.0 mm for 125 mm X 25 mm Corrugation or 3.5 mm 68 X 13 mm Corrugation
2000 mm to 2400 mm	2.8 mm for 125 mm x 25 mm Corrugation or 4.2 mm for 68 x 13 mm Corrugation
2401 mm to 3600mm	3.5 mm for 125 mm x 25 mm Corrugation

420.02.02 Plastic Pipe Materials

Couplers, wyes, tees, adaptors, bends, nuts, bolts and plastic pipe, consisting of corrugated polyethylene pipe, shall be of a type, size and strength acceptable to the Owner's Representative.

420.03 PIPE INSTALLATION

All pipe shall be handled with care, so as not to damage the pipes or their protective coatings. Each pipe shall be inspected for defects before being lowered into the trench. Any pipe that is defective or unsound, in the opinion of the Owner's Representative, shall not be incorporated in the work.

The pipe shall be installed in accordance with the requirement given in Form 1235.

No pipe laying shall commence until a bed has been prepared to the alignment and grades as required by the Owner's Representative, and until the trench has been constructed to satisfaction of the Owner's Representative.

The Contractor shall provide such unwatering as is required.

No pipe shall be laid or joined when the trench bottom is frozen or under water or when, in the Owner's Representative's opinion, the trench conditions or the weather are unsuitable for such work.

All pipe shall be laid to the line and grades staked by the Owner's Representative.

Pipe to be laid at a location shall be that size and type of pipe that the Owner's Representative required to be laid at that location.

Riveted corrugated steel pipe shall be laid with the inside circumferential laps pointing in the direction of the flow. The longitudinal laps shall be located in the upper half of the pipe.

Helical aluminized or polymer laminated corrugated steel pipe shall be installed so that the helix angle is constant for the total length of the installation and each pipe section shall be installed next to the previous section such that the lock-seam forms a continuous helix.

Adapters, bends, wyes or tees shall be installed where required by the Owner's Representative.

Pipes shall be cut whenever necessary to permit the installation of adaptors, bends, wyes, tees, or catch basins at the places staked by the Owner's Representative.

At catch basins, the pipe shall be cut so that pipe ends will not project more than 300 millimetres in from the walls of the catch basin.

Pipe cuts shall be made neatly at right angles to the axis of the pipe.

Where aluminized or polymer laminated corrugated steel pipe is cut, drilled, or welded, the pipe shall be thoroughly cleaned with a wire brush to remove scale, rust, slag residue,

weld spatter, etc., and wiped clean. The cleaned surface shall receive at least one application of metal conditioner to de-oxidize, degrease, and phosphatize the metal surface to be treated if the surface is oily. Pre-mixed, ready-to-apply, liquid zinc compound shall be applied to the prepared clean dry metal surface. The cold-galvanizing compound must be of a type that imparts cathodic action against corrosion.

The cold-galvanizing compound should have a minimum 50 millimetre overlap of the surrounding undamaged metal.

All cut edges and any damage to aluminized or polymer laminated coatings shall be repaired in accordance with the latest version of CSA G401.

Aluminized or polymer laminated corrugated steel pipe sections shall be joined together by means of aluminized or polymer laminated steel couplers. The couplers shall be installed to lap approximately equal portions of the pipe being connected and such that the corrugations or projections of the coupler properly engage the pipe corrugations. As the coupler is being tightened, it shall be tapped with a mallet to take up the slack.

The interior of pipes shall be carefully cleaned of all dirt, cement or superfluous material of every description as the work progresses.

At times when pipe laying is not in progress, the open ends of the pipe shall be closed by a watertight plug or other means deemed acceptable by the Owner’s Representative. If water is in the trench when work recommences, then the plug shall remain in place until the trench is pumped completely dry.

The alignment of sewer pipes between catch basins shall be tested as each portion is laid. The Owner’s Representative may order a strong light to be supplied by the Contractor, which will be shone through the pipe from catch basin to catch basin. If less than half of the full diameter of the end of the pipe at the light source is visible from the far end, then the Owner’s Representative may order the pipes realigned at the Contractor's expense.

Perforated steel pipe shall be laid with the perforations downwards and symmetrical about the vertical axis.

The upstream ends of perforated pipe shall be sealed by means of a concrete plug. When the pipe is in position the wet concrete shall be placed in the open end of the pipe. The concrete shall fill the end of the pipe to a length equal to the diameter of the pipe.

420.04 MEASUREMENT FOR PAYMENT

Measurement for payment for supply and installation of pipe for storm sewers and perforated pipe for sub-drains, consisting of pipe of a particular size and type shall be the actual in place end to end length, measured in metres to one decimal place, along the centre line of the completed new pipe line made up of material of that size and type.

Pipe length, couplers, adaptors, wyes, tees or bends not actually incorporated into a storm sewer or sub-drain will not be included in measurement for payment.

420.05 BASIS OF PAYMENT

420.05.01 Basis of Payment for Supply and Installation of Pipe for Storm Sewers and Perforated Pipe for Sub-Drainage

Payment at the contract price for the type and size of storm sewer or perforated pipe sub-drain specified shall be compensation in full for all labour, materials and equipment use to: supply the pipe, couplers, wyes, tees, bends, adaptors, nuts and bolts, transport the materials to the project, store the materials at the project, transport the materials to the site, cut the pipe, clean cut ends, supply and apply metal conditioner and cold-galvanizing compound to cut ends of galvanized pipe, install storm sewer or sub-drain as required, provide concrete plugs for sub-drains, and provide any unwatering that is required.

420.05.02 Basis of Payment for Pipe Restocking

Contractors are advised that should less than the contract estimated quantity of pipe of a particular size and type be required, then the Contractor will be compensated for restocking this excess pipe at the rate of 15% of the contract unit price for the Supply and Installation of Pipe Culvert of this size and type.

However, should there be no contract price for the Supply and Installation of Pipe Culvert of this size and type, then the compensation for restocking this excess pipe shall be at the rate of 15% of the contract unit price for; the Supply and Installation of Pipe for Storm Sewers of this size, or the supply and installation pipe for sub-drainage of this size, as appropriate.

Restocking shall include such things as handling, all transportation and any other expenses associated with removing the excess pipe from the project site, and returning it to the supplier or to the Contractor's permanent storage areas.

420.05.03 Basis of Payment for Pipe Purchase

Contractors are advised that should less than the contract estimated quantity of pipe of a particular size and type be required, the Department reserves the right to purchase the

excess. Compensation for purchase will be at the invoiced price for that pipe from the pipe supplier plus 10%.

SECTION 421

SUPPLY AND INSTALLATION OF PIPE CULVERTS

INDEX

421.01 SCOPE

This specification covers the requirements for the supply, installation and backfilling of factory fabricated pipe culverts, including the extension of existing culverts. Pipe culverts may be round or arched pipe.

Should end-treatments such as concrete headwalls, gabions or rip rap be required, then the requirements for these will be covered separately in other items and specifications.

421.02 MATERIALS

Pipe shall consist of aluminized steel pipe type 2 or polymer laminated in accordance with the Corrugated Steel Pipe Institute (CSPI) Performance Guideline for Corrugated Steel Pipe Culverts (300 millimetres to 3600 millimetres in Diameter), concrete, or corrugated polyethylene pipe of profile type and strength as specified in the unit price table. However,

Contractors are advised that consideration will be given to proposals to substitute aluminized steel type 2 pipe with corrugated polyethylene pipe for diameters of up to and including 600 millimetres. The pipe shall be of the type, strength and size specified in the Unit Price Table.

421.02.01 Aluminized or Polymer Laminated Steel Pipe Materials

Aluminized or polymer laminated corrugated steel pipe, couplers, wyes, tees, bends, adapters, nuts and bolts shall conform to the requirements of the most recent revisions of the following specifications: AASHTO M274 and M36, ASTM A760/A760M, ASTM A762/A762M, ASTM A929/A929M and CSA G401.

The pipe shall have a wall thickness of at least that specified in the Unit Price Table. However, should the wall thickness not be specified, then the wall thickness shall be at least the corresponding thickness given in the following table for pipe of the size and type required.

PIPE DIAMETER	MINIMUM WALL THICKNESS
100 mm to 1200 mm	2.0 mm for Any Corrugation
1400 mm to 1800 mm	2.0 mm for 125 mm X 25 mm Corrugation or 3.5 mm for 68 X 13 mm Corrugation
2000 mm to 2400 mm	2.8 mm for 125 mm X 25 mm Corrugation or 4.2 mm for 68 X 13 mm Corrugation
2401 mm to 3600 mm	3.5 mm for 125 mm X 25 mm Corrugation

The Contractor shall supply the pipe, couplers, nuts and bolts. Should strutting be required during backfill operations, then the Contractor shall provide the necessary timber.

Fill material to be placed within 300 millimetres of the top, bottom and the sides of corrugated pipe shall consist of clean well graded Other Material, or small sized shot rock. The maximum dimension of any stone in the Other Material, or in the shot rock, shall not exceed 75 millimetres

421.02.02 Plastic Pipe Materials

Polyethylene pipe, couplers, wyes, tees, bends, and adapters shall conform to the requirements of the most recent revisions of the following specifications: AASHTO M252 and M294, ASTM F667 and CSA B182.6 and B182.8.

Couplers and plastic pipe, consisting of corrugated polyethylene pipe, shall be of a type, profile, size and strength class acceptable to the Owner's Representative. The Contractor shall provide the plastic pipe and couplers.

Contractors are advised that should plastic pipe be used, then the pipe shall be installed in a Select Backfill Material consisting of well graded Other Material having no more than 10% passing the 0.075 millimetre sieve with a maximum particle size not exceeding 40 millimetres.

421.03 ENVIRONMENTAL PERMITS AND AUTHORIZATIONS

Authorization from the Fish and Fish Habitat Protection Program, Fisheries and Oceans Canada, is required for work in or near any watercourse or water body deemed to be viable fish habitat.

Where required by Fisheries and Oceans, a downstream pool shall be provided at the culvert outlet.

The Contractor shall provide such unwatering as is required to complete the culvert installation in the dry and to comply with all regulatory agency requirements. The unwatering shall be carried out in accordance with the requirements of Section 180.

The Contractor shall be aware of Division 8.

Where the stream is deemed to be viable fish habitat, then in order to assist fish passage during minimum flow periods, the culvert shall be installed such that the bottom of the culvert is at least 300 millimetres below the natural stream bed. In multiple culvert installations, then to assist fish passage, only one culvert need be installed with the invert at least 300 millimetres below natural stream bed.

421.04 PIPE INSTALLATION

Culvert pipes shall be laid to the alignment, length and grade staked by the Owner's Representative.

Driveway culverts will typically be: a minimum length of 7 metres if rip-rap end treatment is used, and a minimum length of 8 metres if no rip-rap is used.

The culvert shall be installed in accordance with the requirements given in Form 1236 for aluminized or polymer laminated steel pipe installation and with the requirements given in Form 1234a, 1234b or 1234c for polyethylene pipe installation.

Should excavation be required to install the pipe at the required grade, then excavation shall be carried out and paid for in accordance with Section 403.

Where unsuitable material is encountered at the proposed pipe invert grade, then the unsuitable material shall be excavated and replaced.

The replaced material shall be compacted to not less than 95% of Standard Proctor Density (ASTM D698).

The bed shall be shaped to conform to the bottom of the pipe and shall afford a uniformly firm bed throughout its entire length.

When extending an existing culvert, the Contractor shall brush off all soil sticking to that part of the existing pipe that will be lapped.

When laying pipe, should the required culvert length be unobtainable from a combination of pipe lengths available on the site, then the Contractor shall cut a piece of pipe to obtain the required length of culvert. The cut or short section shall be placed on the down stream end.

Pipe cuts shall be made neatly at right angles to the axis of the pipe.

Riveted or annular aluminized type II or polymer laminated corrugated steel pipe and plastic pipe shall be laid with the inside circumferential laps pointing in the direction of the flow. The longitudinal laps shall be located in the upper half of the pipe.

Helical corrugated plastic and aluminized type II or polymer laminated steel pipe shall be installed such that the helix angle is constant for the total length of the installation and each pipe section shall be installed next to the previous section such that the lock seam forms a continuous helix.

Should concrete headwall be installed under another item, then backfilling against the headwalls shall not commence until the concrete has been cured to the specified design strength at 28 days. Should the Contractor wish to commence backfilling before 28 days after pouring, then the Contractor will be required to prove that the 28 days specified design strength has been obtained before permission to commence backfilling will be granted.

The material shall be carefully placed so that the intended shape of the pipe is maintained and no damage or movement of the culvert occurs.

The backfill material shall be placed simultaneously on both sides of the pipe in layers not exceeding 200 millimetres in thickness. Each layer shall be thoroughly tapped to a compaction not less than 95% of Standard Proctor Density before a further layer is placed.

Backfilling shall be continued until all parts of the pipe culvert have not less than 300 millimetres of backfill cover.

Any pipe which is not in the alignment and to the grade required by the Owner's Representative after laying shall be taken up and re-laid at the Contractor's expense.

421.04.01 Aluminized or Polymer Laminated Corrugated Steel Pipe Installation

Where excavation for foundation is required before an aluminized or polymer laminated corrugated steel pipe may be placed in Other Material ground, then the excavation shall be to the proposed invert elevations and graded so as to provide a uniformly firm bed throughout the length of the culvert.

However, in solid rock, the excavation shall be carried out to a depth of 150 millimetres below the proposed invert elevations so that fill material may be placed to provide a bed for the culvert. The fill material shall be placed and graded so as to provide a uniform bed throughout the length of the culvert.

Where an aluminized or polymer laminated corrugated steel pipe is cut, drilled or welded, the pipe shall be thoroughly cleaned with a wire brush to remove scale, rust, slag residue, weld splatter, and wiped clean. The clean surface shall receive at least one application of metal conditioner to de-oxidize, de-grease and phosphatize the metal surface to be treated if the surface is oily. Pre-mixed, ready-to-apply, liquid-zinc compound shall be applied to the prepared clean dry metal surface. The cold galvanizing compound must be of a type that imparts cathodic action against corrosion. The cold galvanizing compound should have a minimum 50 millimetres overlap of the surrounding undamaged aluminized metal and have a minimum dry thickness of 75µm.

When applying metal conditioner and cold galvanizing compound near a watercourse or water body, the Contractor shall ensure that the application is carried out carefully so as to prevent leakage or spillage.

Any damage to aluminized coatings shall be repaired in accordance with the latest version of CSA G401.

Uncoated areas wider than 50mm shall be replaced with new material or re-dipped in accordance with CSA G401.

Any damage to polymer coatings shall be promptly repaired in accordance with CSPI Technical Bulletin Number Two. The damaged area shall receive a zinc rich coating with a minimum dry thickness of 75µm, Denso Butyl Spray Primer and Denso Tape. For coating damage exceeding 50mm in width; the Contractor shall submit an engineered repair plan which ensures a 75 year design life and is manufacturer approved. The acceptance of the repair procedure shall be at the sole discretion of the Department. Should the Department find the repair procedure unacceptable then the damaged pipe culvert will be rejected and shall be replaced with a new, undamaged pipe culvert. All costs associated with preparation of repair procedures and repairing or replacing the damaged pipe culvert shall be borne entirely by the Contractor.

Corrugated pipe sections shall be jointed together by means of couplers. The couplers shall be installed to lap approximately equal portions of the pipe being connected and such that the corrugations or projections of the coupler properly engage the pipe corrugations. As the coupler is being tightened, it shall be tapped with a mallet to take up the slack.

Strutting will be required for corrugated steel pipe culverts of diameter or span greater than 1500 millimetres in order to ensure that the original shape of the culvert is retained after completion of backfilling operations.

Strutting shall be placed to the satisfaction of the Owner's Representative. Struts shall be placed such that they bear onto longitudinally placed members. Under no circumstances shall struts be placed so that they bear directly onto the walls of the pipe.

Struts shall be left in place until ordered removed by the Owner's Representative at the completion of backfiling operations. For aluminized or polymer laminated corrugated steel pipe of diameter 2400 millimetres or less, the minimum required cover to subgrade is 300 millimetres. For aluminized or polymer laminated corrugated steel pipe of diameter between 2400 millimetres and 3600 millimetres, the minimum required cover is 500 millimetres.

421.04.02 Plastic Pipe Installation

Plastic pipe shall be laid on a bed of 150 millimetres of Select Backfill Material.

Where excavation for foundation is required, the excavation shall be to 150 millimetres below the proposed invert elevations so that Select Backfill Material may be placed to provide a bed for the culvert.

The Select Backfill Material shall be placed and shaped to conform to the underside of the culvert and graded so as to provide a uniformly firm bed throughout the length of the culvert.

The cover shall not be less than the manufacturer's recommended minimum cover.

421.05 PROTECTION FROM TRAFFIC

Prior to allowing the movement of construction equipment or any vehicular traffic over the structure, the depth of cover over the culvert shall be at least equal to that stipulated under Section 421.04. Cover for off highway construction equipment will be in addition to that specified above.

421.06 MEASUREMENT FOR PAYMENT

Measurement for payment for a culvert shall be the length of the culvert within the limits staked by the Owner’s Representative, measured in metres, to one decimal place, along the bottom of the new culvert.

Should any part of the culvert extend beyond the limits as staked by the Owner’s Representative, then that part beyond the limits shall not be included in measurement for payment.

421.07 BASIS OF PAYMENT

421.07.01 Basis of Payment for Supply and Installation of Pipe Culverts

Payment at the contract price for the type and size of pipe culvert specified shall be compensation in full for all labour, materials and equipment use to: supply the pipe, couplers, nuts and bolts, transport the materials to the project, store the materials at the project, transport the materials to the site, cut the pipe if required, clean the cut end, supply and apply metal conditioner and cold galvanizing compound to all cuts and welds, assemble the culvert, place and compact bedding and backfill as required, supply and place any required strutting, remove the strutting and provide all required unwatering of the culvert site during installation.

Select Backfill for use with plastic pipe shall be paid for in accordance with Section 206, Section 207, or Section 310 as the case may be, but the additional requirements for these

materials as stipulated in this specification shall be considered compensated for in the contract price for supply and installation of pipe culverts.

Backfill for use near aluminized or polymer laminated corrugated steel pipes will be obtained from materials excavated to place the pipes. Should the Owner's Representative determine that the excavated material be unsuitable for backfill, or should additional backfill materials be required, the backfill materials shall be paid for in accordance with Section 206, or Section 207, as the case may be, but the additional requirements for backfilling, as stipulated in this specification shall be considered compensated for in the contract price for supply and installation of pipe culverts.

421.07.02 Basis of Payment for Pipe Restocking

Contractors are advised that should less than the contract estimated quantity of pipe of a particular size and type be required, then the Contractor will be compensated for restocking this excess pipe at the rate of 15% of the Contract Unit Price for the supply and installation of pipe culvert of this size and type. Restocking shall include such things as handling, all transportation and any other expenses associated with removing the excess pipe from the project site and returning it to the supplier or to the Contractor's permanent storage area.

421.07.03 Basis of Payment for Purchase of Pipe

Contractors are advised that should less than the contract estimated quantity of pipe of a particular size and type be required, the Department reserves the right to purchase the excess. Compensation for purchase will be at the invoiced price for that pipe from the pipe supplier plus 10%.

SECTION 422

SADDLE BRANCH SUPPLY AND INSTALLATION

INDEX

422.01 SCOPE

This specification covers the requirements for the supply and installation of a saddle branch to connect a smaller pipe to a corrugated steel pipe culvert (CSP) or storm sewer. The work involves: cutting into the CSP, the supply and installation of the saddle branch to the CSP, and the joining of the smaller pipe to the saddle branch.

Excavation and backfilling required in making the connection will be covered separately under Section 404 and bedding will be covered under Section 410.

422.02 MATERIALS

The saddle branch shall consist of 1.6 millimetre aluminized or polymer laminated corrugated steel, manufactured to a size and shape suitable for connecting the smaller pipe to the corrugated steel pipe.

See Form 1219.

After fabrication, the saddle branch and saddle branch welds shall be either factory galvanized or treated as follows. Where corrugated steel pipe is cut, drilled, or welded, the pipe shall be thoroughly cleaned with a wire brush to remove scale, rust, slag residue, weld splatter, etc. and wiped clean. The cleaned surface shall receive at least one application of metal conditioner to de-oxidize, de-grease, and phosphatize the metal surface to be treated if the surface is oily. Pre-mixed, ready-to-apply, liquid-zinc compound should be applied to the prepared clean dry metal surface. The cold-galvanizing compound must be of a type that imparts cathodic action against corrosion.

The cold-galvanizing compound should have a minimum 50 millimetre overlap of the surrounding undamaged aluminized or polymer laminated metal.

All cut edges and any damage to aluminized or polymer laminated coatings shall be repaired in accordance with the latest version of CSA G401.

Nuts, bolts and washers shall consist of galvanized steel.

Materials including saddle branch, nuts, bolts, washers, metal conditioner, cold-galvanizing compound shall be supplied by the Contractor.

422.03 INSTALLATION

Excavation required at the required point of connection shall be carried out in accordance with Section 404. The Contractor shall brush off all soil or dirt sticking to that part of the CSP where the connection is to be made.

The Contractor shall cut a neat hole of suitable size in the CSP at the location where the connection is to be made. Holes shall be drilled in the CSP at required locations in preparation for connecting the saddle branch.

The Contractor shall treat both the cut edge and drilled holes as outlined above.

After the cold-galvanizing compound is thoroughly dry, the saddle branch shall be securely bolted to the wall of the CSP and the pipe secured to the other end of the saddle branch.

422.04 MEASUREMENT FOR PAYMENT

Measurement for payment for saddle branch supply and installation, shall be by the number of saddle branches of a particular size and type installed.

422.05 BASIS OF PAYMENT

Payment at the contract price for each saddle branch of the type and size specified shall be compensation for all labour, materials, and equipment use to: clean pipes to be connected, cut a hole into the wall of the corrugated steel pipe, drill the bolt holes, surface preparation, the supply and application of metal conditioner, cold-galvanizing compound, the supply of the saddle branch, nuts, bolts and washers, the connection of the saddle branch of the CSP and the connection of the pipe to be saddle branched, together with such unwatering as may be required to carry out the work.

SECTION 423

SUPPLY AND INSTALLATION OF STURUCTURAL PLATE PIPE

INDEX

423.01 SCOPE

This specification covers the requirements for the supply and installation of structural plate round pipe and structural plate pipe-arch as new construction, or, where specified, to extend an existing structural plate pipe.

The structural plate round pipe or structural plate pipe-arch shall be of the size, thickness, and type specified in the contract documents.

The Contractor shall be responsible for quality control for the supply and installation of the Structural Plate Pipe.

Should headwalls be required, then they shall be covered separately under Section 451.

423.02 COORDINATION AND PLANNING

The Contractor shall be fully responsible for the comprehensive planning, coordination, and scheduling of all aspects related to the supply and installation of the Structural Plate Pipe, including but not limited to: submissions, mandatory inspections, quality control reporting and materials testing. The Contractor shall collaborate closely with the designated Owner's Representative throughout the entire process of the structure's installation, ensuring that all requirements outlined in the contract and specifications are met in a timely and efficient manner.

Failure to establish or maintain regular and clear communication with the Owner's Representative will not be considered an acceptable justification for non-compliance with this specification. The Contractor is expected to proactively manage all project activities and to give ample and reasonable notification to the Owner's Representative throughout all aspects of the structural plate pipe installation.

423.03 SUBMITTALS

423.03.01 General Requirements

The Contractor shall submit in a timely fashion all shop drawings for the Structural Plate Pipe. Drawings shall clearly show the dimensions of all components, materials, thicknesses, and special details. Drawings shall also detail the recommended backfill specifications, gradation, extents and backfilling procedures.

Shop drawings for the structure shall be received, reviewed and accepted by the Department prior to fabrication of the structure. All issued for construction submittals shall be received 2 weeks prior to the start of construction. The Contractor shall allow a minimum of 2 weeks for shop drawing review.

The Contractor is reminded of General Condition 41.3 and their responsibility to review, stamp, date and sign all submittals. Prior to the submission of shop drawings, all documents must be reviewed by the Contractor to ensure that the Department receives a compliant submission. The Department will not review a submittal which does comply with the above requirement.

Any changes, deletions, omissions etc. to the Department's specifications shall be highlighted with each submission, with each instance specifically stated and explained for consideration by the Owner's Representative.

The above submittals for the structure shall be received, reviewed and accepted by the Department prior to fabrication of the structure.

Once submittals are accepted by the Department then no changes can be made by the Contractor or the Contractor's Engineer without the submission of such changes and written approval from the Owner's Representative acknowledging acceptance of such changes.

All drawings and technical specifications shall be in accordance with PEGNL's "Guideline for preparation of Engineering and Geoscience Drawings and Technical Specifications".

The manufacturer shall provide a copy of the plant certificate of conformance for Corrugated Steel Structures. The manufacturer's plant certificate of conformance shall be issued by an independent 3rd party certification agency who are accredited by the Standards Council of Canada, confirming that the manufacturer produces certified corrugated steel pipe products in accordance with CSA G401.The structure shall have two identifier plates attached to the upper ends of the structure or individual plates

containing the Certifying Agency's logo, manufacturer name, serial / project number and supply year.

Mill certificates for the material, as well as other Quality Assurance documentation related to the design and fabrication of the structure shall be available upon request.

423.03.02 Quality Control Plan

The Contractor shall submit to the Department a Quality Control Plan which ensures conformance with the requirements stipulated by the manufacturer, designer, CAN/CSA S6, CSA G401 and the Contract Documents.

The Department requires a minimum of 2 weeks to review the Quality Control Plan. The Contractor's finalized Quality Control Plan must be submitted minimum of 2 weeks prior to construction.

No work shall commence until the Contractor's Quality Control Plan has been reviewed and accepted by the Department.

The Contractor's Quality Control Plan shall bear the stamp of a Professional Engineer licensed to practice in the Province of Newfoundland and Labrador.

At a minimum the Contractor's Quality Control Plan shall include the following:

423.03.02.01 Bolt Torque Testing

The Contractor shall include in their Quality Control Plan a procedure that ensures that assembly and erection is in accordance with latest version of CAN/CSA S6, with the following exception:

423.03.02.01.01 Initial Assembly

The torque on all bolts prior to backfilling shall be in accordance with ASTM A807/807M for steel structures and ASTM B789/789M for aluminum structures. A minimum of 10% of all bolts shall be tested after assembly. The tested bolts shall be randomly selected and the bolted assembly shall only be accepted if at least 90% of bolts test above the torque requirement.

Should the tested bolts not meet the 90% threshold stated above, then the Contractor shall randomly select 50% of the remaining untested bolts for additional testing. The bolted assembly shall only be accepted if at least 90% of the additional bolts tested satisfy the torque requirement. Otherwise, the Contractor shall re-torque all bolts.

Failure to obtain written acceptance of the initial assembly bolt torque testing results, prior to commencing backfill operations, shall result in the immediate rejection of the entire plate assembly.

423.03.02.01.02 During Backfill Operations

Upon acceptance of the initial assembly bolt torque testing results by the Department, backfilling operations may commence in accordance with Section 423.03.02.03.

During the backfilling operation a minimum of 5% of the bolts shall be randomly selected for testing. Testing shall be carried out as backfilling progresses and shall include the bolts which are exposed (above the current level of backfill at the time of testing). Bolts shall be randomly selected and the bolted assembly shall only be accepted when at least 90% of the bolts tested satisfy the torque requirement.

Should the tested bolts not meet the 90% threshold stated above, then the Contractor shall randomly select 25% of the remaining bolts for additional testing. The bolted assembly shall be accepted if at least 90% of the additional bolts tested satisfy the torque requirement. Otherwise, the Contractor shall re-torque all bolts, or as directed by the Owner's Representative.

423.03.02.01.03 Bolt Testing Results

All bolt testing results shall be provided to the Owner's Representative as they become available. Bolt testing from initial assembly must be submitted and accepted by the Owner's Representative prior to commencing backfilling operations.

Bolt torque results must be signed by the Contractor's Representative and include: date, time, location, equipment used and height of backfill.

423.03.02.02 Shape Monitoring

The Contractor must detail in their Quality Control Plan a procedure for monitoring shape throughout construction. Deflections from the specified dimensions shall be within the tolerances permitted by the soil-metal structure designer. Acceptable shape monitoring tolerances for the specific structure must be clearly shown in the Quality Control Plan and Shop Drawings.

All surveying shall be non-destructive in nature. No permanent alterations shall be made to the structure as part of this quality control activity.

All shape monitoring results shall be provided to the Owner's Representative as they become available. Shape monitoring results must be signed by the Contractor's Representative and include: date, time, location and equipment used.

423.03.02.03 Backfill Testing and Compaction

The Contractor's material testing, backfilling and inspection plan must be detailed in their Quality Control Plan. Select Backfill quality control procedures shall be compliant with Section 411.

All material testing requirements, testing methods, and frequency of testing for the select backfill material shall be clearly identified.

All equipment being used in backfilling operations must be listed. Maximum backfill lift thickness must be identified.

All details are to be provided on construction loading; including minimum heights of cover during construction and the use of any specific equipment and weights being utilized.

The backfilling and inspection plan shall indicate which third party geotechnical engineering consultant has been engaged to certify select backfill compaction. The plan shall also include the method and frequency by which the compaction is being tested.

All backfill material testing shall be promptly provided to the Owner's Representative as they become available. Backfill operations shall not commence until all material testing is complete and is accepted by the Department.

Compaction testing must be promptly provided to the Owner's Representative as the backfilling operations progress.

A comprehensive summary testing package, including all relevant material, electrochemical, and compaction testing results shall be submitted to the Department for its records. This package must be stamped and certified by the Contractor's Geotechnical Engineer of Record.

423.03.02.04 Manufacturer's Installation and Best Practices Manual

The manufacturer's installation and best practices guide shall form part of the Contractor's Quality Control Plan.

423.03.02.05 Handling, Shipping and Storage

As part of the Quality Control Plan the Contractor must detail the transportation, handling and storage methods for the structure. The methodology must be shown to be in conformance with the manufacturer's recommendations.

423.03.02.06 Letters of Conformance

The Contractor's Quality Control Plan shall list all letters of conformance which are required to be submitted to the Department. These include, but are not limited to:

- Manufacturer's Plant Certificate of Conformance
- Contractor's Geotechnical Engineer's Letter of Conformance (Materials Testing)
- Contractor's Geotechnical Engineer's Letter of Conformance (Compaction)

423.03.02.07 Material on Site

The Contractor's Quality Control Plan must include details to demonstrate compliance with Section 423.05 of this Specification.

As part of this procedure the Contractor must ensure that structure materials are made available and fully visible to the Owner's Representative for inspection and initial acceptance. The Contractor is advised that final acceptance of the structure material will only be given once the structure is completely installed and backfilled.

423.03.03 Quality Control Reporting

All quality control documentation shall be provided to the Department as the project progresses. Documentation shall include, but is not limited to: structure alignment/shape monitoring, bolt torque testing, material testing, and compaction testing. Failure to provide this information shall result in the issuance of a stop work order. Delays resulting from the failure to submit quality control documentation shall not form the basis of any claim.

Quality control reporting shall be promptly provided as the installation progresses.

As a minimum, the Contractor is required to submit a daily work report for each day that work is performed on-site. The report must summarize the following: a description of the work completed, the equipment utilized and present on-site, any significant issues or challenges encountered, and any quality control test results conducted during the day. The report must also include photographic documentation of the ongoing work activities, with the images clearly illustrating the progress made and specific tasks completed on that day. Additionally, the daily report must be dated and signed by the Contractor's Representative, verifying the accuracy of the information provided. Reports must be

submitted to the Owner's Representative no later than the following morning to ensure timely review and record-keeping.

Failure to submit quality control reporting in a timely manner shall result in a 10% holdback on the Structural Plate Pipe, until such time that the required reports have been submitted to, and accepted by, the Owner's Representative.

423.03.04 List of Required Submittals

To ensure proper documentation and conformance, the following items must be submitted by the Contractor at the specified stages of the installation. At a minimum the required submittals include, but are not limited to the following:

- Structure Shop Drawings
- Quality Control Plan
- Manufacturer's Plant Certificate of Conformance
- Bolt Torque Testing Results
    - Initial Assembly
    - During Backfill
- Structure Alignment/Shape Monitoring Testing Results
- Daily Quality Control Reporting
- Backfill Material Testing Results (Gradation and Electrochemical)
    - Backfill Sample Provided to Owner's Representative
- Contractor's Geotechnical Engineer's Letter of Conformance (Materials Testing)
- Backfill Material Testing Results (Compaction)
- Contractor's Geotechnical Engineer's Letter of Conformance (Compaction)
- Comprehensive Summary Testing Package

423.04 ENVIRONMENTAL PERMITS AND AUTHORIZATIONS

Authorization from the Department of Fisheries and Oceans Canada's Fish and Fish Habitat Protection Program is required for work in or near any watercourse or water body deemed to be viable fish habitat.

Where required by Fisheries and Oceans, a downstream pool shall be provided at the pipe outlet.

Structural plate pipes are to be installed such that the bottom of the pipe is at least 300 millimetres below the natural streambed. This will allow the deposition of stream gravels in the pipe providing a natural appearing streambed and will assist fish passage during minimum flow periods.

For stream crossings requiring multiple pipe installations, only the pipe designed to carry minimum flows shall be installed to maintain fish passage (i.e. countersunk a minimum of 300 millimetres). The other pipes shall normally be installed along the streambed or at an elevation determined by the Owner's Representative.

Work is to be carried out in accordance with all requirements stipulated by regulatory agencies whose approval is required. This includes, but is not limited to, the Department of Fisheries and Oceans Canada, Transport Canada's Navigation Protection Program and the Water Resources Division of the Department of Environment, Climate Change and Municipalities.

Where unwatering is required, the contractor shall carry out this work in accordance with Section 180.

The Contractor shall be aware of the requirements of Division 8.

423.05 MATERIALS

423.05.01 Fabrication

Structural components shall be carefully formed to the corrugation profile and curved to the required radius along the inner crest, in the manufacturer's plant.

Fabrication of all components must meet the requirements of CAN/CSA G401 or ASTM A761, as applicable.

423.05.02 Materials for Steel Structures

Steel plate to conform to the latest version of CSA G401.

Corrugated steel structural plate shall meet the general requirements as specified in CSA G401.

For galvanized structures, a zinc coating shall be applied after fabrication. The coating must provide a minimum coating weight of 915 grams per square metre total on both sides of the corrugated steel plates in accordance with CSA G401.

For structures that are specified by the Department to have a thermoplastic copolymer coating; a thermoplastic copolymer coating shall be applied to both sides of the corrugated steel plates in accordance with CSA G401.

Bolts and nuts for the structural plate connections shall be heavy hex, meeting the requirements of CSA G401. Anchor bolts shall meet CSA G401. All fasteners and anchor bolts shall be zinc coated in accordance with CSA G401.

For thermoplastic copolymer coated structures all fasteners shall be in accordance with the latest version of CSPI Technical Bulletin Issue Twenty-Three.

Steel for base channels, if required, to conform to CSA G401.

423.05.03 Materials for Aluminum Structures

Aluminum plates to conform to the latest version of ASTM B746.

The aluminum structural plate shall meet the general requirements as specified in ASTM B746. Bolt holes shall be 25 millimetres in diameter using 19 millimetre diameter (3/4” diameter) bolts.

Bolts and nuts for the structural plate connections shall be heavy hex.

Steel bolts shall meet the requirements of CSA G401. Anchor bolts shall meet CSA G401.

All fasteners and anchor bolts shall be coated in accordance with CSA G401.

Aluminum bolts shall meet the requirements of ASTM F468, made from Alloy 6061-T6.

Aluminum nuts shall meet the requirements of ASTM F467, made from Alloy 6061-T6.

423.06 HANDLING, SHIPPING AND STORAGE

The Contractor shall be responsible for the acceptance, unloading, handling, and storage of all material delivered to the project site. All components shall be handled, stored and shipped in such a manner as to eliminate the potential for damage as detailed in the manufacturer’s installation guide. All damaged components shall be rejected by the Department and replaced at the Contractor’s expense. Any loss or damage to material after acceptance shall be replaced by the Contractor at their own expense. Damaged components shall include, but is not limited to, any structural plates which exhibit permanent deformation or strain.

Stockpile lay down areas shall be specified by the Contractor prior to the start of construction, and will be subject to the approval of the Owner’s Representative. Stockpile locations shall be at or near the project site.

The stockpile lay down areas shall not impact the operation and/or access to utilities, including but not limited to power lines, waterlines, and underground utilities. The Contractor shall acquire any required approvals, clearances, or permits for stockpile lay down areas prior to the start of construction. Work is to be carried out in accordance with all requirements stipulated by regulatory or utility agencies whose approval is required. This includes, but is not limited to, the Department of Fisheries and Oceans Canada and the Water Resources Division of the Department of Environment and Climate Change. The Contractor shall be aware of the requirements of Division 8.

Stockpile lay down areas shall be cleaned of any debris and objectionable material by the Contractor prior to placing the material. This cleaning shall be considered incidental to the work. Stockpile lay down areas shall have a uniform smooth surface and be graded to ensure positive drainage away from the stockpile materials.

For any stockpile lay down areas on private property, the Contractor shall obtain a signed agreement with the property owner prior to the start of construction. This agreement shall be submitted to the Owner's Representative for review and approval at minimum ten (10) working days prior to the start of construction.

Structural plate and any other fabricated material shall be stored at least 150 mm above ground level, in an organized fashion, and be supported to prevent any permanent deformation, in a manner acceptable to the Owner's Representative. Structural plates and fasteners shall be stored in accordance with CSPI Technical Bulletin 28. For the purposes of this specification, long term storage is defined as a period exceeding 3 months or for material stored over the Winter Season (December to May). Stockpiled material must be protected from environmental damage and corrosion, in a manner acceptable to the Owner's Representative. For long term storage, the Contractor shall provide a detailed storage plan to the Owner's Representative for their review and acceptance. The Contractor shall adhere to any additional storage requirements specified by the manufacturer or as directed by the Owner's Representative.

The Contractor shall be responsible for providing any and all required security to prevent loss or damage to stockpiled materials. Any lost or damaged stockpiled material shall be replaced by the Contractor at their own expense.

423.07 EXCAVATION

The Contractor shall excavate a foundation within the limits and to the grade as staked by the Owner's Representative. This excavation shall be carried out and paid for in accordance with Section 403.

The foundation shall be excavated to a depth of 300 millimetres below the proposed grade of the invert and to a width equal to the width of the proposed structural plate pipe or pipe-arch plus half the span on each side, or as directed by the Owner's Representative.

The Contractor shall assemble the structure on a suitable foundation as approved by the Owner's Geotechnical Engineer.

423.08 EXTENSIONS TO EXISTING STRUCTURAL PLATE

When specified, the work will involve extending an existing structural plate pipe. Where the pipe has a beveled end on the end to be extended, then the Contractor shall remove the plates comprising the beveled end before adding the extension. The plates comprising the dismantled beveled end shall be disposed of by the Contractor at their own expense.

Where in order to secure the extension to the existing pipe, cuts need to be made, or bolt holes need to be drilled in the existing pipe, then the Contractor shall make such cuts or holes as are necessary. Cuts and holes shall be made in such a manner so as to leave neat edges.

In the case of extensions or modifications to existing pipe all cutting and drilling shall be reviewed and accepted by the supplier and the Owner's Representative. Cuts (if essential) shall be made with saws and holes (if essential) shall be drilled. Following such alteration, the Contractor shall clean, pre-treat if necessary and coat all damaged sections with cold-galvanizing compound as outlined. The cold-galvanizing compound shall be allowed to thoroughly dry before adding the extension.

Where corrugated steel pipe is cut, drilled, or welded the pipe shall be thoroughly cleaned with a wire brush to remove scale, rust, slag residue, weld splatter, and wiped clean. The clean surface shall receive at least one application of metal conditioner to de-oxidize, de-grease, and phosphatize the metal surface to be treated if the surface is oily. Pre-mixed, ready-to-apply, liquid-zinc compound should be applied to the prepared clean dry metal surface. The cold-galvanizing compound must be of a type that imparts cathodic action against corrosion. The cold-galvanizing compound should have a minimum 50 millimetre overlap of the surrounding undamaged galvanized metal.

When applying a metal conditioner and a cold galvanizing compound near a watercourse or water body, the Contractor shall ensure that the application is carried out carefully as to prevent leakage or spillage.

All cut edges and any damage to galvanized or polymer coatings shall be repaired in accordance with the latest version of CSA G401

All materials must be applied in accordance with the manufacturer's instructions.

423.09 BEDDING

The Contractor shall prepare a bed to the alignment, shape of underside of the structural plate and grade, as required by the Owner's Representative.

See Form 1231 and Form 1232 for typical details.

Select bedding material shall be used to prepare the bed. Select bedding material shall satisfy the following soil classification requirements:

1. ASTM D2487 - Group GW, SW, GP, GW-GM, or SW-SM
2. ASTM D6913 - Maximum 25mm particles size
   Minimum Gravel Content 35% (particle size > 4.75mm)
   Less than 50% passing the 0.150mm sieve
   Less than 10% passing the 0.075mm sieve
3. ASTM D4318 - Plasticity index less than 6%
4. Uniformity Coefficient (Cu): $Cu \geq 4$
5. Coefficient of Curvature (Cc): $1 \leq Cc \leq 3$
6. Angularity of non-crushed Materials, ASTM D2488: > 35% Angular/Sub-angular
7. Flat/Elongates, ASTM D2488 or ASTM D4791: <25%
8. Los Angeles Abrasion Loss, ASTM C131: < 40%
9. Magnesium sulphate Soundness Loss, AASHTO T104: < 30% after four cycles

No material testing requirements shall be waved.

The bedding directly below structural plate pipe shall be lightly compacted to the required grade and shaped with a thin layer of loose select bedding in direct contact with the invert plates. All remaining bedding shall be compacted to at least 95% of Standard Proctor Dry Density (ASTM D698).

423.10 ASSEMBLY

The Contractor shall load the plates, nuts, bolts, washers, ribs if required, and all necessary hardware at the point of supply and transport them to the installation site.

Plates shall be bolted at longitudinal and circumferential seams such that no more than 3 plates overlap at any bolt hole on the main barrel.

The cutting or drilling of holes in new structural plates in the field is not permitted without the Owner's written approval. On a case-by-case basis the Contractor shall submit to the Department a detailed request to modify structural plate, which includes but is not limited to: drilling, cutting etc. Requests of this nature must also be accompanied by a manufacturer approved repair procedure.

Any defective plate(s) must be reported to the supplier and corrective action taken by the supplier or the manufacturer.

The Contractor shall assemble the structure using procedures as recommended by the supplier and in accordance with the instructions of the Owner's Representative.

The Contractor shall brush off all soil sticking to the outside of those parts of plates that are to be lapped when joined.

Structural plate pipes may be assembled at the proposed location or at the side of the location. If the assembled structure has to be moved to its final position it shall be moved in such a manner that no damage or distortion is caused to the structure or the bedding.

The structural plate pipe shall be placed to the required alignment, and grade and be within the required limits, as specified by the Owner's Representative.

After complete assembly all bolts shall be re-tightened with a torque wrench to comply with the manufacturer's specified torque requirements.

Any damage to metallic coatings shall be repaired in accordance with the latest version of CSA G401, with the following exception; an individual structural plate shall be rejected by the Department for either of the following:

- If an individual uncoated/damaged area exceeds 300mm in any one dimension.
- If an individual uncoated/damaged area exceeds 50mm in both dimensions.
- If the total combined uncoated/damaged surface area measures more than 1% of the total surface area.

In any of the above cases the Contractor may propose an engineered repair plan for consideration by the Department. If the Department elects not to accept the engineered repair plan, the structural plate shall be replaced with new material, or be re-dipped in

accordance with CSA G401. The acceptance of the repair procedure shall be at the sole discretion of the Department.

Any damage to polymer coatings shall be promptly repaired in accordance with CSA G401 and CSPI Technical Bulletin Number Two, with the following exception; an individual structural plate shall be rejected by the Department for either of the following:

- If an individual uncoated/damaged area exceeds 300mm in any one dimension.
- If an individual uncoated/damaged area exceeds 50mm in both dimensions.
- If the total combined uncoated/damaged surface area measures more than 1% of the total surface area.

In any of the above cases the Contractor may propose an engineered repair plan for consideration by the Department. If the Department elects not to accept the engineered repair plan, the structural plate shall be replaced with new material, or be re-coated in accordance with CSA G401. The acceptance of the repair procedure shall be at the sole discretion of the Department.

All costs associated with preparation of repair procedures and repairing or replacing the damaged structural plate components shall be borne entirely by the Contractor.

423.11 BACKFILLING

423.11.01 Select Backfill and Material Testing

Backfill material in the engineered backfill zone shall be clean, well graded, granular material meeting the strength, gradation, compressibility and electrochemical requirements specified herein.

Unless otherwise specified the select backfill envelope shall be as shown in Form 1231 and Form 1232, as appropriate. The engineered backfill envelop shall meet the requirements of the latest CAN/CSA-S6 design code.

All select backfill shall be provided from a single source.

When the air temperature is below 0°C, no backfilling is allowed. Frozen granular backfill materials will not be permitted. No backfill material will be permitted to be placed directly on frozen substrate.

It shall be the Contractor’s responsibility to carry-out all required testing. The Contractor shall use professional geotechnical engineering services and a qualified testing firm licensed in Newfoundland and Labrador for all sampling and testing of the select backfill.

All material testing shall be carried-out on a project specific basis. Material testing results obtained from an alternate project will not be accepted by the Department.

At least two weeks prior to start of construction the Contractor shall identify the source of materials to be used for the select backfill and provide initial testing for the select backfill. This testing shall include both gradation and electrochemical testing as a minimum. A copy of these test results shall be provided to the Owner's Representative. The Contractor shall provide a letter of conformance from their third party geotechnical consultant stating that the material testing results are in compliance with this specification. Letters of conformance shall bear the stamp of a Professional Engineer licensed to practice in the Province of Newfoundland and Labrador.

Select backfill material shall satisfy the following soil classification requirements:

1. ASTM D2487 - Group GW, SW, GP, GW-GM, or SW-SM
2. ASTM D6913 - Maximum 75mm particles size
   Minimum Gravel Content 35% (particle size > 4.75mm)
   Less than 50% passing the 0.150mm sieve
   Less than 10% passing the 0.075mm sieve
3. ASTM D4318 - Plasticity index less than 6%
4. Uniformity Coefficient (C_u): $C_u \geq 4$
5. Coefficient of Curvature (C_c): $1 \leq C_c \leq 3$
6. Angularity of non-crushed Materials, ASTM D2488: > 35% Angular/Sub-angular
7. Flat/Elongates, ASTM D2488 or ASTM D4791: < 25%
8. Los Angeles Abrasion Loss, ASTM C131: < 40%
9. Magnesium sulphate Soundness Loss, AASHTO T104: < 30% after four cycles

No material testing requirements shall be waved.

All select backfill material must conform to the following electro-chemical limits per AASHTO LRFD specifications as detailed in Table 4 of Corrugated Steel Pipe Institute's (CSPI) Technical Bulletin Thirteen.

As a minimum requirement, the select backfill material shall be tested in accordance with AASHTO or ASTM standard methods and meet the following criteria:

ELECTRO-CHEMICAL PARAMETER	ELECTRO-CHEMICAL REQUIREMENT	TEST METHOD	
		AASHTO	ASTM
Chlorides (Cl^-)	< 100 ppm	T291	D512
Sulphates (SO_4^{2-})	< 200 ppm	T290	D516
Resistivity	> 3000 ohm-cm	T288	G57
pH	5 – 10	T289	G51
Max Organic Content	< 1%	T267	-

In addition to the initial gradation and electrochemical testing, the Contractor shall sample and test the backfill for conformance with the gradation requirements at least once for every 250 cubic metres of material placed.

The Contractor shall also provide a 20 kilogram representative sample of the backfill proposed for construction to the Owner's Representative for testing and approval two weeks prior to start of construction. The sample provided shall meet the geotechnical parameters as specified.

All sampling shall be carried out in the presence of the Owner's Representative.

Additional gradation testing at the Contractor's expense may be required if based upon visual inspection in the field it is evident to the Owner's Representative that the gradation of the select backfill material has changed.

Gradation requirements will be strictly enforced and variances to coarser or less well graded material will not be accepted.

The Contractor shall also be responsible for testing to establish the Standard Proctor Maximum Dry Density (ASTM 698) of the approved backfill and will be responsible for having the compaction of each lift of backfill tested for conformance with the compaction requirements specified in Section 423.11.02.

All results shall be provided to the Owner's Representative as the work progresses.

Where conventional material testing is not possible, the Contractor shall use professional engineering services licensed to practice in Newfoundland and Labrador to provide a visual inspection of each lift, ensuring proper compaction. The Contractor shall provide a letter of conformance from the third party engineering firm stating that the select backfill meets the compaction requirements of this specification

There will be no payment for installation until all initial testing results have been submitted to the Owner's Representative and deemed acceptable.

Timely submission of all required gradation and compaction testing results shall be provided to the Owner's Representative as the work progresses. The Contractor is advised that failure to provide testing results, or failure to meet the specified requirements, may result in the rejection of the select backfill material. Select backfill rejected by the Department as a result of not meeting the material requirements of this specification, shall be carefully excavated and replaced in accordance with this specification, at the Contractor's expense.

The Contractor is advised that the Department may elect to carryout quality assurance work in relation to any aspect of this structure. No delay claims will be accepted as a result of this activity.

Where there are discrepancies between the Department's and manufacturer's specifications then the more stringent requirement shall govern.

Upon request by the Department, where the Contractor is procuring select backfill material from a third party, the Contractor shall provide proof of delivery for all select backfill material.

423.11.02 Backfilling Operations

The Contractor shall notify the Owner's Representative a minimum of 7 days prior to the commencement of backfilling operations.

Backfilling shall not commence until concrete headwalls have achieved at least 70% of the specified design strength at 28 days or cured for seven days, whichever comes first. This requirement may be increased by the Owner's Representative.

The backfill material shall be uniformly placed in compacted lifts on both sides of the structure. The backfill lifts shall not exceed 250 millimetres in depth (before compaction) and shall be compacted to a minimum of 98% Standard Proctor Dry Density (ASTM D698).

The difference in levels of the backfill on the two sides at any transverse section shall not exceed two compacted lift thickness and the maximum particle size of 75 millimetres within 300 millimetres of the structure.

The select backfill shall extend along the sides of the structure at least a half span width away from the steel surfaces, or as indicated in the contract documents.

Backfilling with select backfill material shall be continued until all parts of the pipe have not less than 1 metre of backfill cover, or not less than the manufacturer's recommended minimum cover, whichever is less.

Heavy equipment cannot be operated within 1000 millimetres of the structure. Fill within 1000 millimetres of the structure must be placed and compacted using light equipment or by hand.

Loads that exceed design loading are not permitted on the structure. Live Load traffic is not permitted until the structure has been backfilled to the minimum design height of cover without prior approval from the Owner’s Representative.

Backfill shall be carefully placed and compacted so that the correct shape of the structure is maintained. The Contractor shall monitor the shape of the structure during backfilling operations. Any deflection from the specified dimensions shall be within the tolerances noted on the manufacturer’s shop drawings. If deflections exceed the permitted tolerances, then backfilling operations shall be ceased until a suitable procedure is developed by the Contractor and accepted by the Department. The Manufacturer and Owner’s Representative shall be notified of any deflections in writing immediately.

All structural plates which exhibit permanent deformation or strain for any reason shall be rejected by the Department and replaced at the Contractor’s expense.

423.12 PROTECTION FROM TRAFFIC

Prior to allowing the movement of construction equipment or any vehicular traffic over the structure, the depth of cover over the structure shall not be less than the manufacturer’s recommended minimum cover for the particular loading. Any construction equipment exceeding CL-625 loading conditions shall not be permitted over the structure.

423.13 MEASUREMENT FOR PAYMENT

Measurement for payment for a structural plate pipe shall be the actual length of the new pipe measured in metres, rounded to one decimal place, along the bottom of the pipe.

423.14 BASIS FOR PAYMENT

Payment at the contract price for the size, thickness, and type of structural plate pipe specified shall be full compensation for all labour, materials, and equipment-use required

to: supply all plates, nuts, bolts, washers, ribs if required, together with all necessary hardware, load and haul the same from the supply point to the installation site, provide for temporary storage and all rehandling necessary, assemble the structure, locate to alignment, grade, and tolerance specified by the Owner's Representative, place, compact and test select bedding and select backfill as specified herein, together with all labour, materials and equipment-use necessary to provide any required unwatering and quality control.

Where the work involves extending an existing structural plate pipe, then the basis of payment shall, in addition to the aforesaid, also include all labour, materials and equipment-use for: removing and disposing of the existing beveled end or ends (if any), cutting plates (if needed), drilling holes (if needed), cleaning, and treating, supplying and applying cold-galvanizing compound to any cuts or drilled holes.

Select bedding material and select backfill material shall be paid for in accordance with Section 206 or Section 207 or Section 310 as the case may be, but the additional requirements for bedding and backfilling as stipulated in this specification shall be considered compensated for in the contract price for the supply and installation of the structural plate pipe.

All excavation required for a new pipe or to expose the end of an existing pipe where an extension is required shall be paid for in accordance with Section 403 for (a) Solid Rock or (b) Other Material, as the case may be.

Payment for the long span structural plate structure, including materials, will only be made once the structure is installed, backfilled and all letters of conformance have been received and accepted by the Department. No interim payments will be considered.

Contractors are advised that any failure to fully comply with all specified requirements, including but not limited to the timely submission of documentation, completion of necessary material testing, and adherence to all quality control protocols as outlined in this specification, shall result in the unconditional rejection of the structural plate installation. This decision will be made at the sole discretion of the Department, and no further consideration for acceptance or approval of the installation will be given unless all requirements are met in accordance with the established specification.

SECTION 424

SUPPLY AND INSTALLATION OF STRUCTURAL PLATE ARCH

INDEX

424.01 SCOPE

This specification covers the requirements for the supply, installation, and backfilling of an open bottom structural plate arch to extend an existing structural plate arch or new construction.

The structural arch shall be of the size, thickness, and type specified in the contract documents.

The Contractor shall be responsible for quality control for the supply and installation of the Structural Plate Arch.

The provision of footings for the structural plate arch is covered under Section 450.

Should headwalls be required, then they shall be covered separately under Section 451.

424.02 COORDINATION AND PLANNING

The Contractor shall be fully responsible for the comprehensive planning, coordination, and scheduling of all aspects related to the supply and installation of the Structural Plate Arch, including but not limited to: submissions, mandatory inspections, quality control reporting and materials testing. The Contractor shall collaborate closely with the designated Owner's Representative throughout the entire process of the structure's installation, ensuring that all requirements outlined in the contract and specifications are met in a timely and efficient manner.

Failure to establish or maintain regular and clear communication with the Owner's Representative will not be considered an acceptable justification for non-compliance with this specification. The Contractor is expected to proactively manage all project activities and to give ample and reasonable notification to the Owner's Representative throughout all aspects of the structural plate arch installation.

424.03 SUBMITTALS

424.03.01 General Requirements

The Contractor shall submit in a timely fashion all shop drawings for the Structural Plate Arch. Drawings shall clearly show the dimensions of all components, materials, thicknesses, and special details. Drawings shall also detail the recommended backfill specifications, gradation, extents and backfilling procedures.

Shop drawings for the structure shall be received, reviewed and accepted by the Department prior to fabrication of the structure. All issued for construction submittals shall be received 2 weeks prior to the start of construction. The Contractor shall allow a minimum of 2 weeks for shop drawing review.

The Contractor is reminded of General Condition 41.3 and their responsibility to review, stamp, date and sign all submittals. Prior to the submission of shop drawings, all documents must be reviewed by the Contractor to ensure that the Department receives a compliant submission. The Department will not review a submittal which does comply with the above requirement.

Any changes, deletions, omissions etc. to the Department's specifications shall be highlighted with each submission, with each instance specifically stated and explained for consideration by the Owner's Representative.

The above submittals for the structure shall be received, reviewed and accepted by the Department prior to fabrication of the structure.

Once submittals are accepted by the Department then no changes can be made by the Contractor without the submission of such changes and written approval from the Owner's Representative acknowledging acceptance of such changes.

All drawings and technical specifications shall be in accordance with PEGNL's "Guideline for preparation of Engineering and Geoscience Drawings and Technical Specifications

The manufacturer shall provide a copy of the plant certificate of conformance for Corrugated Steel Structures. The manufacturer's plant certificate of conformance shall be issued by an independent 3rd party certification agency who are accredited by the Standards Council of Canada, confirming that the manufacturer produces certified corrugated steel pipe products in accordance with CSA G401.The structure shall have two identifier plates attached to the upper ends of the structure or individual plates containing the Certifying Agency's logo, manufacturer name, serial / project number and supply year.

Mill certificates for the material, as well as other Quality Assurance documentation related to the design and fabrication of the structure shall be available upon request.

424.03.02 Quality Control Plan

The Contractor shall submit to the Department a Quality Control Plan which ensures conformance with the requirements stipulated by the manufacturer, designer, CAN/CSA S6, CSA G401 and the Contract Documents.

The Department requires a minimum of 2 weeks to review the Quality Control Plan. The Contractor's finalized Quality Control Plan must be submitted minimum of 2 weeks prior to construction.

No work shall commence until the Contractor's Quality Control Plan has been reviewed and accepted by the Department.

The Contractor's Quality Control Plan shall bear the stamp of a Professional Engineer licensed to practice in the Province of Newfoundland and Labrador.

At a minimum the Contractor's Quality Control Plan shall include the following:

424.03.02.01 Bolt Torque Testing

The Contractor shall include in their Quality Control Plan a procedure that ensures that assembly and erection is in accordance with latest version of CAN/CSA S6, with the following exception:

424.03.02.01.01 Initial Assembly

The torque on all bolts prior to backfilling shall be in accordance with ASTM A807/807M for steel structures and ASTM B789/789M for aluminum structures. A minimum of 10% of all bolts shall be tested after assembly. The tested bolts shall be randomly selected and the bolted assembly shall only be accepted if at least 90% of bolts test above the torque requirement.

Should the tested bolts not meet the 90% threshold stated above, then the Contractor shall randomly select 50% of the remaining untested bolts for additional testing. The bolted assembly shall only be accepted if at least 90% of the additional bolts tested satisfy the torque requirement. Otherwise, the Contractor shall re-torque all bolts.

Failure to obtain written acceptance of the initial assembly bolt torque testing results, prior to commencing backfill operations, shall result in the immediate rejection of the entire plate assembly.

424.03.02.01.02 During Backfill Operations

Upon acceptance of the initial assembly bolt torque testing results by the Department, backfilling operations may commence in accordance with Section 424.03.02.03.

During the backfilling operation a minimum of 5% of the bolts shall be randomly selected for testing. Testing shall be carried out as backfilling progresses and shall include the bolts which are exposed (above the current level of backfill at the time of testing). Bolts shall be randomly selected and the bolted assembly shall only be accepted when at least 90% of the bolts tested satisfy the torque requirement.

Should the tested bolts not meet the 90% threshold stated above, then the Contractor shall randomly select 25% of the remaining bolts for additional testing. The bolted assembly shall be accepted if at least 90% of the additional bolts tested satisfy the torque requirement. Otherwise, the Contractor shall re-torque all bolts, or as directed by the Owner's Representative.

424.03.02.01.03 Bolt Testing Results

All bolt testing results shall be provided to the Owner's Representative as they become available. Bolt testing from initial assembly must be submitted and accepted by the Owner's Representative prior to commencing backfilling operations.

Bolt torque results must be signed by the Contractor's Representative and include: date, time, location, equipment used and height of backfill.

424.03.02.02 Shape Monitoring

The Contractor must detail in their Quality Control Plan a procedure for monitoring shape throughout construction. Deflections from the specified dimensions shall be within the tolerances permitted by the soil-metal structure designer. Acceptable shape monitoring tolerances for the specific structure must be clearly shown in the Quality Control Plan and Shop Drawings.

All surveying shall be non-destructive in nature. No permanent alterations shall be made to the structure as part of this quality control activity.

All shape monitoring results shall be provided to the Owner's Representative as they become available. Shape monitoring results must be signed by the Contractor's Representative and include: date, time, location, and equipment used.

424.03.02.03 Backfill Testing and Compaction

The Contractor's material testing, backfilling and inspection plan must be detailed in their Quality Control Plan. Select Backfill quality control procedures shall be compliant with Section 411.

All material testing requirements, testing methods, and frequency of testing for the select backfill material shall be clearly identified.

All equipment being used in backfilling operations must be listed. Maximum backfill lift thickness must be identified.

All details are to be provided on construction loading; including minimum heights of cover during construction and the use of any specific equipment and weights being utilized.

The backfilling and inspection plan shall indicate which third party geotechnical engineering consultant has been engaged to certify select backfill compaction. The plan shall also include the method and frequency by which the compaction is being tested.

All backfill material testing shall be promptly provided to the Owner's Representative as they become available. Backfill operations shall not commence until all material testing is complete and is accepted by the Department.

Compaction testing must be promptly provided to the Owner's Representative as the backfilling operations progress.

A comprehensive summary testing package, including all relevant material, electrochemical, and compaction testing results shall be submitted to the Department for its records. This package must be stamped and certified by the Contractor's Geotechnical Engineer of Record.

424.03.02.04 Manufacturer's Installation and Best Practices Manual

The manufacturer's installation and best practices guide shall form part of the Contractor's Quality Control Plan.

424.03.02.05 Handling, Shipping and Storage

As part of the Quality Control Plan the Contractor must detail the transportation, handling and storage methods for the structure. The methodology must be shown to be in conformance with the manufacturer's recommendations.

423.03.02.06 Letters of Conformance

The Contractor's Quality Control Plan shall list all letters of conformance which are required to be submitted to the Department. These include, but are not limited to:

- Manufacturer's Plant Certificate of Conformance
- Contractor's Geotechnical Engineer's Letter of Conformance (Materials Testing)
- Contractor's Geotechnical Engineer's Letter of Conformance (Compaction)

424.03.02.07 Material on Site

The Contractor's Quality Control Plan must include details to demonstrate compliance with Section 424.04.04 of this Specification.

As part of this procedure the Contractor must ensure that structure materials are made available and fully visible to the Owner's Representative for inspection and initial acceptance. The Contractor is advised that final acceptance of the structure material will only be given once the structure is completely installed and backfilled.

424.03.03 Quality Control Reporting

All quality control documentation shall be provided to the Department as the project progresses. Documentation shall include, but is not limited to: structure alignment/shape monitoring, bolt torque testing, material testing, and compaction testing. Failure to provide this information shall result in the issuance of a stop work order. Delays resulting from the failure to submit quality control documentation shall not form the basis of any claim.

Quality control reporting shall be promptly provided as the installation progresses.

As a minimum, the Contractor is required to submit a daily work report for each day that work is performed on-site. The report must summarize the following: a description of the work completed, the equipment utilized and present on-site, any significant issues or challenges encountered, and any quality control test results conducted during the day. The report must also include photographic documentation of the ongoing work activities, with the images clearly illustrating the progress made and specific tasks completed on that day. Additionally, the daily report must be dated and signed by the Contractor's Representative, verifying the accuracy of the information provided. Reports must be

submitted to the Owner's Representative no later than the following morning to ensure timely review and record-keeping.

Failure to submit quality control reporting in a timely manner shall result in a 10% holdback on the Structural Plate Arch, until such time that the required reports have been submitted to, and accepted by, the Owner's Representative.

424.03.04 List of Required Submittals

To ensure proper documentation and conformance, the following items must be submitted by the Contractor at the specified stages of the installation. At a minimum the required submittals include, but are not limited to the following:

- Structure Shop Drawings
- Quality Control Plan
- Manufacturer's Plant Certificate of Conformance
- Bolt Torque Testing Results
    - Initial Assembly
    - During Backfill
- Structure Alignment/Shape Monitoring Testing Results
- Daily Quality Control Reporting
- Backfill Material Testing Results (Gradation and Electrochemical)
    - Backfill Sample Provided to Owner's Representative
- Contractor's Geotechnical Engineer's Letter of Conformance (Materials Testing)
- Backfill Material Testing Results (Compaction)
- Contractor's Geotechnical Engineer's Letter of Conformance (Compaction)
- Comprehensive Summary Testing Package

424.04 ENVIRONMENTAL PERMITS AND AUTHORIZATIONS

Authorization from the Department of Fisheries and Oceans Canada's Fish and Fish Habitat Protection Program is required for work in or near any watercourse or water body deemed to be viable fish habitat.

Where required by Fisheries and Oceans, a downstream pool shall be provided at the structural plate arch outlet.

Work is to be carried out in accordance with all requirements stipulated by regulatory agencies whose approval is required. This includes, but is not limited to, the Department of Fisheries and Oceans Canada, Transport Canada's Navigation Protection Program

and the Water Resources Division of the Department of Environment, Climate Change and Municipalities.

Where unwatering is required, the contractor shall carry out this work in accordance with Section 180.

The Contractor shall be aware of the requirements of Division 8.

424.05 MATERIALS

424.05.01 Fabrication

Structural components shall be carefully formed to the corrugation profile and curved to the required radius along the inner crest, in the manufacturer's plant.

Fabrication of all components must meet the requirements of CAN/CSA G401 or ASTM A761, as applicable.

424.05.02 Materials for Steel Structures

Steel plate to conform to the latest version of CSA G401.

Corrugated steel structural plate shall meet the general requirements as specified in CSA G401.

For galvanized structures, a zinc coating shall be applied after fabrication. The coating must provide a minimum coating weight of 915 grams per square metre total on both sides of the corrugated steel plates and base channels in accordance with CSA G401.

For structures that are specified by the Department to have a thermoplastic copolymer coating; a thermoplastic copolymer coating shall be applied to both sides of the corrugated steel plates and base channels in accordance with CSA G401.

Bolts and nuts for the structural plate connections shall be heavy hex, meeting the requirements of CSA G401. Anchor bolts shall meet CSA G401. All fasteners and anchor bolts shall be zinc coated in accordance with CSA G401.

For thermoplastic copolymer coated structures all fasteners shall be in accordance with the latest version of CSPI Technical Bulletin Issue Twenty-Three.

Steel for base channels, if required, to conform to CSA G401.

424.05.03 Materials for Aluminum Structures

Aluminum plates to conform to the latest version of ASTM B746.

The aluminum structural plate shall meet the general requirements as specified in ASTM B746. Bolt holes shall be 25 millimetres in diameter using 19 millimetre diameter (3/4" diameter) bolts.

Bolts and nuts for the structural plate connections shall be heavy hex.

Steel bolts shall meet the requirements of CSA G401. Anchor bolts shall meet CSA G401.

All fasteners and anchor bolts shall be coated in accordance with CSA G401.

Aluminum bolts shall meet the requirements of ASTM F468, made from Alloy 6061-T6.

Aluminum nuts shall meet the requirements of ASTM F467, made from alloy 6061-T6.

424.06 HANDLING, SHIPPING AND STORAGE

The Contractor shall be responsible for the acceptance, unloading, handling, and storage of all material delivered to the project site. All components shall be handled, stored and shipped in such a manner as to eliminate the potential for damage as detailed in the manufacturer's installation guide. All damaged components shall be rejected by the Department and replaced at the Contractor's expense. Any loss or damage to material after acceptance shall be replaced by the Contractor at their own expense. Damaged components shall include, but is not limited to, any structural plates which exhibit permanent deformation or strain.

Stockpile lay down areas shall be specified by the Contractor prior to the start of construction, and will be subject to the approval of the Owner's Representative. Stockpile locations shall be at or near the project site.

The stockpile lay down areas shall not impact the operation and/or access to utilities, including but not limited to power lines, waterlines, and underground utilities. The Contractor shall acquire any required approvals, clearances, or permits for stockpile lay down areas prior to the start of construction. Work is to be carried out in accordance with all requirements stipulated by regulatory or utility agencies whose approval is required. This includes, but is not limited to, the Department of Fisheries and Oceans Canada and the Water Resources Division of the Department of Environment and Climate Change. The Contractor shall be aware of the requirements of Division 8.

Stockpile lay down areas shall be cleaned of any debris and objectionable material by the Contractor prior to placing the material. This cleaning shall be considered incidental to the work. Stockpile lay down areas shall have a uniform smooth surface and be graded to ensure positive drainage away from the stockpile materials.

For any stockpile lay down areas on private property, the Contractor shall obtain a signed agreement with the property owner prior to the start of construction. This agreement shall be submitted to the Owner's Representative for review and approval at minimum ten (10) working days prior to the start of construction.

Structural plate and any other fabricated material shall be stored at least 150 mm above ground level, in an organized fashion, and be supported to prevent any permanent deformation, in a manner acceptable to the Owner's Representative. Stockpiled material shall also be protected from environmental damage and corrosion, in a manner acceptable to the Owner's Representative. Structural plates and fasteners shall be stored in accordance with CSPI Technical Bulletin 28. For the purposes of this specification, long term storage is defined as a period exceeding 3 months or for material stored over the Winter Season (December to May). Stockpiled material must be protected from environmental damage and corrosion, in a manner acceptable to the Owner's Representative. For long term storage, the Contractor shall provide a detailed storage plan to the Owner's Representative for their review and acceptance. The Contractor shall adhere to any additional storage requirements specified by the manufacturer or as directed by the Owner's Representative.

The Contractor shall be responsible for providing any and all required security to prevent loss or damage to stockpiled materials. Any lost or damaged stockpiled material shall be replaced by the Contractor at their own expense.

424.07 EXCAVATION

The Contractor shall excavate a foundation within the limits and to the grade as staked by the Owner's Representative. This excavation shall be carried out and paid for in accordance with Section 403.

The foundation shall be excavated to the required depth of the proposed depth of the underside of footing and to a width equal to the width of the proposed structural plate arch structure plus half the span on each side, or as directed by the Owner's Representative.

The Contractor shall assemble the structure on a suitable foundation as approved by the Owner's Geotechnical Engineer.

424.08 EXTENSIONS TO EXISTING STRUCTURAL PLATE

When specified, the work will involve extending an existing structural plate arch. Where the arch has a beveled end on the end to be extended, then the Contractor shall remove the plates comprising the beveled end before adding the extension. The plates comprising the dismantled beveled end shall be disposed of by the Contractor at their own expense

Where in order to secure the extension to the existing arch, cuts need to be made, or bolt holes need to be drilled in the existing arch, then the Contractor shall make such cuts or holes as are necessary. Cuts and holes shall be made in such a manner so as to leave neat edges.

In the case of extensions or modifications to existing arches all cutting and drilling shall be reviewed and accepted by the supplier and the Owner's Representative. Cuts (if essential) shall be made with saws and holes (if essential) shall be drilled. Following such alteration, the Contractor shall clean, pre-treat if necessary and coat all damaged sections with cold-galvanizing compound as outlined. The cold-galvanizing compound shall be allowed to thoroughly dry before adding the extension.

Where corrugated steel arch is cut, drilled, or welded the arch shall be thoroughly cleaned with a wire brush to remove scale, rust, slag residue, weld splatter, and wiped clean. The clean surface shall receive at least one application of metal conditioner to de-oxidize, de-grease, and phosphatize the metal surface to be treated if the surface is oily. Pre-mixed, ready-to-apply, liquid-zinc compound should be applied to the prepared clean dry metal surface. The cold-galvanizing compound must be of a type that imparts cathodic action against corrosion. The cold-galvanizing compound should have a minimum 50 millimetre overlap of the surrounding undamaged galvanized metal.

When applying a metal conditioner and a cold galvanizing compound near a watercourse or water body, the Contractor shall ensure that the application is carried out carefully as to prevent leakage or spillage.

All cut edges and any damage to galvanized or polymer coatings shall be repaired in accordance with the latest version of CSA G401

All materials must be applied in accordance with the manufacturer's instructions.

424.09 ASSEMBLY

The Contractor shall load the plates, base channels, nuts, bolts, washers, ribs if required, and all necessary hardware at the point of supply and transport them to the installation site.

The Contractor shall allow the concrete footings to cure for at least three days before commencing the assembly of the structural plate and the bolting of the plates to the channel embedded in the footing.

Plates shall be bolted at longitudinal and circumferential seams such that no more than 3 plates overlap at any bolt hole on the main barrel.

The cutting or drilling of holes in new structural plates in the field is not permitted without the Owner's written approval. On a case-by-case basis the Contractor shall submit to the Department a detailed request to modify structural plate, which includes but is not limited to: drilling, cutting etc. Requests of this nature must also be accompanied by a manufacturer approved repair procedure.

Any defective plate(s) must be reported to the supplier and corrective action taken by the supplier or the manufacturer.

The Contractor shall assemble the structure using procedures as recommended by the supplier and in accordance with the instructions of the Owner's Representative.

When extending an existing arch, the Contractor shall brush off all soil sticking to the outside of those parts of plates that are to be lapped when joined.

The structural plate arch shall be placed to the required alignment, and grade and be within the required limits, as specified by the Owner's Representative.

After complete assembly all bolts shall be re-tightened with a torque wrench to comply with the manufacturer's specified torque requirements.

Any damage to metallic coatings shall be repaired in accordance with the latest version of CSA G401. With the following exception; an individual structural plate shall be rejected by the Department for either of the following:

- If an individual uncoated/damaged area exceeds 300mm in any one dimension.
- If an individual uncoated/damaged area exceeds 50mm in both dimensions.

- If the total combined uncoated/damaged surface area measures more than 1% of the total surface area.

In any of the above cases the Contractor may propose an engineered repair plan for consideration by the Department. If the Department elects not to accept the engineered repair plan, the structural plate shall be replaced with new material, or be re-dipped in accordance with CSA G401. The acceptance of the repair procedure shall be at the sole discretion of the Department.

Any damage to polymer coatings shall be promptly repaired in accordance with CSA G401 and CSPI Technical Bulletin Number Two With the following exception; an individual structural plate shall be rejected by the Department for either of the following:

- If an individual uncoated/damaged area exceeds 300mm in any one dimension.
- If an individual uncoated/damaged area exceeds 50mm in both dimensions.
- If the total combined uncoated/damaged surface area measures more than 1% of the total surface area.

In any of the above cases the Contractor may propose an engineered repair plan for consideration by the Department. If the Department elects not to accept the engineered repair plan, the structural plate shall be replaced with new material, or be re-coated in accordance with CSA G401. The acceptance of the repair procedure shall be at the sole discretion of the Department.

All costs associated with preparation of repair procedures and repairing or replacing the damaged structural plate arch components shall be borne entirely by the Contractor.

424.10 BACKFILLING

424.10.01 Select Backfill and Material Testing

Backfill material in the engineered backfill zone shall be clean, well graded, granular material meeting the strength, gradation, compressibility and electrochemical requirements specified herein.

The engineered backfill envelop shall meet the requirements of the latest CAN/CSA-S6 design code.

All select backfill shall be provided from a single source.

When the air temperature is below 0°C, no backfilling is allowed. Frozen granular backfill materials will not be permitted. No backfill material will be permitted to be placed directly on frozen substrate.

It shall be the Contractor's responsibility to carry-out all required testing. The Contractor shall use professional engineering services and a qualified testing firm licensed in Newfoundland and Labrador for all sampling and testing of the select backfill.

All material testing shall be carried-out on a project specific basis. Material testing results obtained from an alternate project will not be accepted by the Department.

At least two weeks prior to start of construction the Contractor shall identify the source of materials to be used for the select backfill and provide initial testing for the select backfill. This testing shall include both gradation and electrochemical testing as a minimum. A copy of these test results shall be provided to the Owner's Representative. The Contractor shall provide a letter of conformance from their third party geotechnical consultant stating that the material testing results are in compliance with this specification. Letters of conformance shall bear the stamp of a Professional Engineer licensed to practice in the Province of Newfoundland and Labrador.

Select backfill material shall satisfy the following soil classification requirements:

1. ASTM D2487 - Group GW, SW, GP, GW-GM, or SW-SM
2. ASTM D6913 - Maximum 75mm particles size
   Minimum Gravel Content 35% (particle size > 4.75mm)
   Less than 50% passing the 0.150mm sieve
   Less than 10% passing the 0.075mm sieve
3. ASTM D4318 - Plasticity index less than 6%
4. Uniformity Coefficient (Cu): $Cu \geq 4$
5. Coefficient of Curvature (Cc): $1 \leq Cc \leq 3$
6. Angularity of non-crushed Materials, ASTM D2488: > 35% Angular/Sub-angular
7. Flat/Elongates, ASTM D2488 or ASTM D4791: <25%
8. Los Angeles Abrasion Loss, ASTM C131: < 40%
9. Magnesium sulphate Soundness Loss, AASHTO T104: < 30% after four cycles

No material testing requirements shall be waved.

All select backfill material must conform to the following electro-chemical limits per AASHTO LRFD specifications as detailed in Table 4 of Corrugated Steel Pipe Institute's (CSPI) Technical Bulletin Thirteen.

As a minimum requirement, the select backfill material shall be tested in accordance with AASHTO or ASTM standard methods and meet the following criteria:

ELECTRO-CHEMICAL PARAMETER	ELECTRO-CHEMICAL REQUIREMENT	TEST METHOD	
		AASHTO	ASTM
Chlorides (Cl^-)	< 100 ppm	T291	D512
Sulphates (SO_4^{2-})	< 200 ppm	T290	D516
Resistivity	> 3000 ohm-cm	T288	G57
pH	5 – 10	T289	G51
Max Organic Content	< 1%	T267	-

In addition to the initial gradation and electrochemical testing, the Contractor shall sample and test the backfill for conformance with the gradation requirements at least once for every 250 cubic metres of material placed.

The Contractor shall also provide a 20 kilogram representative sample of the backfill proposed for construction to the Owner's Representative for testing and approval two weeks prior to start of construction. The sample provided shall meet the geotechnical parameters as specified.

All sampling shall be carried out in the presence of the Owner's Representative.

Additional gradation testing at the Contractor's expense may be required if based upon visual inspection in the field it is evident to the Owner's Representative that the gradation of the select backfill material has changed.

Gradation requirements will be strictly enforced and variances to coarser or less well graded material will not be accepted.

The Contractor shall also be responsible for testing to establish the Standard Proctor Maximum Dry Density (ASTM 698) of the approved backfill and will be responsible for having the compaction of each lift of backfill tested for conformance with the compaction requirements specified in Section 424.08.02.

All results shall be provided to the Owner's Representative as the work progresses.

Where conventional material testing is not possible the Contractor shall use professional engineering services licensed to practice in Newfoundland and Labrador to provide a visual inspection of each lift, ensuring proper compaction. The Contractor shall provide a

letter of conformance from the third party engineering firm stating that the select backfill meets the compaction requirements of this specification

There will be no payment for installation until all initial testing results have been submitted to the Owner's Representative and deemed acceptable.

Timely submission of all required gradation and compaction testing results shall be provided to the Owner's Representative as the work progresses. The Contractor is advised that failure to provide testing results, or failure to meet the specified requirements, may result in the rejection of the select backfill material. Select backfill rejected by the Department as a result of not meeting the material requirements of this specification, shall be carefully excavated and replaced in accordance with this specification, at the Contractor's expense.

The Contractor is advised that the Department may elect to carryout quality assurance work in relation to any aspect of this structure. No delay claims will be accepted as a result of this activity.

Where there are discrepancies between the Department's and manufacturer's specifications then the more stringent requirement shall govern.

Upon request by the Department, where the Contractor is procuring select backfill material from a third party, the Contractor shall provide proof of delivery for all select backfill material.

424.10.02 Backfilling Operations

The Contractor shall notify the Owner's Representative a minimum of 7 days prior to the commencement of backfilling operations.

Backfilling shall not commence until any concrete footings, headwalls and wing walls have cured to at least 70% of the specified design strength at 28 days or cured for seven days, whichever comes first. This requirement may be increased by Engineer of Record for the reinforced concrete components.

Backfilling with select backfill material shall be continued until all parts of the arch have not less than 1 metre of backfill cover, or not less than the manufacturer's recommended minimum cover, whichever is less.

The backfill material shall be uniformly placed in compacted lifts on both sides of the structure. The backfill lifts shall not exceed 250 millimetres in depth (before compaction)

and shall be compacted to a minimum of 98% Standard Proctor Dry Density (ASTM D698).

The difference in levels of the backfill on the two sides at any transverse section shall not exceed two compacted lift thickness and the maximum particle size of 75 millimetres within 300 millimetres of the structure.

The select backfill shall extend along the sides of the structure at least one half the span width away from the steel surfaces, or as indicated in the contract documents.

Backfilling with select backfill material shall be continued until all parts of the arch have not less than 1 metre of backfill cover, or not less than the manufacturer's recommended minimum cover, whichever is less.

Heavy equipment cannot be operated within 1000 millimetres of the structure. Fill within 1000 millimetres of the structure must be placed and compacted using light equipment or by hand.

Loads that exceed design loading are not permitted on the structure. Live Load traffic is not permitted until the structure has been backfilled to the minimum design height of cover without prior approval from the Engineer of Record.

Backfill shall be carefully placed and compacted so that the correct shape of the structure is maintained. The Contractor shall monitor the shape of the structure during backfilling operations. Any deflection from the specified dimensions shall be within the tolerances noted on the manufacturer’s shop drawings. If deflections exceed the permitted tolerances, then backfilling operations shall be ceased until a suitable procedure is developed by the Contractor and accepted by the Department. The Manufacturer and Owner’s Representative shall be notified of any deflections in writing immediately.

All structural plates which exhibit permanent deformation or strain for any reason shall be rejected by the Department and replaced at the Contractor’s expense.

424.11 PROTECTION FROM TRAFFIC

Prior to allowing the movement of construction equipment or any vehicular traffic over the structure, the depth of cover over the structure shall not be less than the manufacturer’s recommended minimum cover for the particular loading. Any construction equipment exceeding CL-625 loading conditions shall not be permitted over the structure.

424.12 MEASUREMENT FOR PAYMENT

Measurement for payment for the supply and installation of Structural Plate Arch shall be the actual length of the new structural plate part of the arch measured in metres, rounded to one decimal place, along the bottom of one side of the new structural plate arch.

424.13 BASIS FOR PAYMENT

Payment at the contract price for the size, thickness, and type of structural plate arch specified shall be full compensation for all labour, materials, and equipment use required to: supply all plates, base channels, nuts, bolts, washers, ribs if required, together with all necessary hardware, load and haul the same from the supply point to the installation site, provide for temporary storage and all rehandling necessary, assemble the structure, and bolt base channels, locate to alignment, grade, and tolerance specified by the Owner's Representative, place, compact and test select backfill as specified herein, together with all labour, materials and equipment-use necessary to provide any required unwatering and quality control.

Where the work involves extending an existing structural plate arch, then the basis of payment shall, in addition to the aforesaid, also include all labour, materials and equipment-use for: removing and disposing of the existing beveled end or ends (if any), cutting plates (if needed), drilling holes (if needed), cleaning and treating, supplying and applying cold-galvanizing compound to any cuts or drilled holes.

Select backfill material shall be paid for in accordance with Section 206 or Section 207 or Section 310 as the case may be, but the additional requirements for bedding and backfilling as stipulated in this specification shall be considered compensated for in the contract price for the supply and installation of the structural plate arch.

All excavation required for a new pipe or to expose the end of an existing pipe where an extension is required shall be paid for in accordance with Section 403 for (a) Solid Rock or (b) Other Material, as the case may be.

Payment for the long span structural plate structure, including materials, will only be made once the structure is installed, backfilled and all letters of conformance have been received and accepted by the Department. No interim payments will be considered.

Contractors are advised that any failure to fully comply with all specified requirements, including but not limited to the timely submission of documentation, completion of necessary material testing, and adherence to all quality control protocols as outlined in this specification, shall result in the unconditional rejection of the structural plate installation. This decision will be made at the sole discretion of the Department, and no

further consideration for acceptance or approval of the installation will be given unless all requirements are met in accordance with the established specification.

SECTION 425

TIMBER CULVERT EXTENSION

INDEX

425.01 SCOPE

This specification covers the requirements for extending existing timber culverts by amounts and to grades as shown on the drawings and as required by the Owner's Representative.

425.02 MATERIALS

Timber for extending timber culverts shall be treated timber of sizes as shown on the drawings.

Spikes and drift bolts together with nuts and washers shall be of the dimensions shown on the drawings.

Wood preservative shall be required. Wood preservative for use in treating field cuts shall be of the same type and chemical composition as that used in the timber for the extension.

The Contractor shall supply the above listed materials.

425.03 EXCAVATION

The Contractor shall excavate a foundation for the proposed extension within the limits and to the grade as staked by the Owner's Representative. This excavation shall be carried out and paid for in accordance with Section 403.

Excavation will normally be to a depth of 600 millimetres below the proposed invert elevation, to a width equal to the outside width of the culvert plus 600 millimetres on each side, and to a length equal to the required length of the extension plus 600 millimetres. Where aprons are required the excavation shall be deepened by an amount equal to the depth of the required apron below the invert.

The sides of the existing end pieces shall normally be excavated to a width 600 millimetres from the face, to a depth 100 millimetres below the bottom of the nailing strip and as far as the start of the existing sheathing.

425.04 BEDDING

The Contractor shall prepare a bed for the nailing strips comprising selected bedding material.

Selected bedding material shall consist of well graded other material, or other material borrow, having no more than 10% passing the 0.075 millimetre sieve and with a particle size not exceeding 75 millimetres.

The bed shall be placed to a compacted grade such that the positioned nailing strips will be at their required grade. The bed shall be placed so that the nailing strips bear completely on firm material leaving no voids under the nailing strip.

The bed shall be compacted to at least 95% of Standard Proctor Density (ASTM D698). After the nailing strips have been placed to the required lines, and to the required grades, then selected bedding material shall be placed between the strips to a compacted grade level with the tops of the nailing strips, so that when placed, the bottom cover will bear completely on firm material. The bedding material between the nailing strips shall be compacted to at least 95% of Proctor Density (ASTM D698).

425.05 ASSEMBLY

The extension shall be carried out in accordance with the drawings and to the satisfaction of the Owner's Representative. The extension shall have the same cross section dimensions as the existing timber culvert.

All field cut ends and field bore holes shall be treated with wood preservative before drive bolts are placed. The field treatment shall be carried out in accordance with Section 590. Before sheathing is applied to the sides of the culvert; the Contractor shall brush off all soil sticking to the sides of the exposed end sections.

425.06 BACKFILLING

Selected backfill material shall be used in backfilling, and it shall consist of well graded other material or other material borrow having no more than 10% passing the 0.075 millimetre sieve and with particle size not exceeding 75 millimetres.

The backfill shall be carefully placed so that no damage occurs to the structure.

The selected backfill material shall be placed simultaneously on both sides of the structure in layers not exceeding 200 millimetres in thickness. The backfill material shall be spread with a light dozer running parallel to, not at right angles to the structure.

Selected backfill shall extend along the sides of the structure at least one span width from each side.

Backfilling with selected backfill shall be extended to subgrade or until all parts of the structure have at least 1.0 metre of cover, whichever is less.

Each layer of selected backfill material shall be compacted to at least 95% of Standard Proctor Density (ASTM D698), before a further layer is placed on top.

Compaction shall be provided by means of a hand held mechanical type compactor. Normal highway fill type compaction equipment shall not be used in close proximity to the structure.

425.07 PROTECTION FROM TRAFFIC

Prior to allowing the movement of construction equipment or any vehicular traffic over the structure the depth of cover shall be such that no damage will occur to the structure.

425.08 MEASUREMENT FOR PAYMENT

Measurement for payment shall be the volume measured in cubic metres, to two decimal places, of the timber actually incorporated into the extension of the culvert. Wasted ends, or timber added in excess of that required by the Owner’s Representative will not be measured for payment.

Volume of timber being assessed as the sum of the individual pieces of timber calculated as the product of measured length, times measured width, times measured depth.

425.09 BASIS OF PAYMENT

Payment at the contract price for timber culvert extension shall be compensation in full for all materials, labour, and use of equipment to: supply all treated lumber, hardware and wood preservative, cut pieces as required, treat cut ends and holes with preservative, construct the extension, and place and compact bedding and backfill as specified, together with the provision of such unwatering as may be required.

Select bedding material and select backfill material shall be paid for in accordance with Section 206, or Section 207 or Section 310, as the case may be, but the additional requirements for bedding and backfilling as stipulated in this specification shall be considered compensated for in the contract price for timber culvert extension.

SECTION 426

DESIGN, SUPPLY, AND INSTALLATION OF LONG SPAN STRUCTURAL PLATE STRUCTURES

INDEX

426.01 SCOPE

This specification covers the requirements for the design, supply, fabrication, delivery, assembly, and backfilling of a structure fabricated from corrugated metal structural plate with spans greater than or equal to 3.0 metres.

The Contractor shall be responsible for the design, supply, installation and all quality control measures associated with the Long Span Structural Plate Structure (LSSPS).

The provision of footings for open bottom structures is covered under Section 450.

Should headwalls be required, then they shall be covered separately under Section 451.

426.02 COORDINATION AND PLANNING

The Contractor shall be fully responsible for the comprehensive planning, coordination, and scheduling of all aspects related to the design, supply and installation of the LSSPS, including but not limited to: submissions, routine and mandatory inspections, quality control reporting and materials testing.

It is strongly recommended that the Contractor hold an internal pre-construction coordination meeting involving their geotechnical engineer, their soil-steel structure designer, the manufacturer, and any other relevant stakeholders. The purpose of this meeting is to ensure that all parties are aligned in their understanding of the quality and installation requirements and to promote the compliant and efficient execution of the work.

The Contractor shall collaborate closely with the designated Owner’s Representative throughout the entire process of the structure’s installation, ensuring that all requirements outlined in the contract and specifications are met in a timely and efficient manner.

Failure to establish or maintain regular and clear communication with the Owner’s Representative will not be considered an acceptable justification for non-compliance with

this specification. The Contractor is expected to proactively manage all project activities and to give ample and reasonable notification to the Owner's Representative throughout all aspects of the LSSPS installation.

426.03 DESIGN

The Contractor shall be responsible for the design of the long span structural plate structure. The long span structure shall be of the stated length, span and rise, although minor variations from the stated span and rise will be considered.

The design shall be carried out in accordance with the latest version of the Canadian Highway Bridge Design Code (CHBDC) CAN/CSA-S6. Design live load shall be CL-625, as per CHBDC, or as stipulated in the contract documents.

The entire structure shall have a design service life of 75 years.

The design shall be completed by a duly qualified Registered Professional Engineer licensed to practice in the Province of Newfoundland and Labrador.

Authentication of all drawings, specifications and submittals must follow PEGNL's, "Guideline for Authenticating Professional Documents".

The structure and the materials comprising the structure shall also be proportioned to carry all the stresses induced by manufacturing, handling, transportation, erection, construction and associated temporary loads in addition to those stipulated by the design code.

Design height of cover varies depending on the shape, design, and loading as specified for the project on the contract documents.

Unfactored reactions for footing design must be provided by the soil-metal structure designer. Maximum allowable settlement values for the soil-metal structure/foundation to be provided to the Department by the designer(s). The most stringent settlement value shall govern design.

For steel structures, the design shall include a calculated 75 year durability allowance that considers water, soil and atmosphere as identified in the Corrugated Steel Pipe Institute (CSPI) Technical Bulletin Thirteen. Soil conditions to be considered in the design shall be as published in Table 4 for AASHTO limits. Water conditions to be considered in the design shall be as detailed in Table 7 for Aggressive corrosivity classification. All structures must be designed as hot dipped galvanized with a minimum zinc mass of 915

g/m^2 total for both sides of the steel, as outlined in CSA G401. Although not considered in the design, if specified, a thermoplastic copolymer coating shall be applied to the plates and base channel as specified in the latest version of CSA G401.

To confirm an accurate durability classification for this site, the Contractor shall carry-out water testing to determine the following water properties listed below:

pH Levels
Concentration of chloride ions (ppm)
Concentration of soluble sulfates (ppm)
Concentration of calcium carbonate/hardness (ppm)
Resistivity (ohm-cm)

In determining these levels a minimum of four samples are to be taken; two readings at the inlet, and two at the outlet. The final result shall be taken as the average of all sample values. A copy of the test results shall be provided to the Department prior to approval of shop drawings.

Where the structure is intended to convey through traffic, provision shall be made to prevent water from the fill seeping through joins in the plates, and then leaking on to the road below. A membrane shall be installed to prevent the ingress of water to the structure/engineered backfill zone and shall have a design life of 75 years. The waterproofing membrane system design shall be completed by the Contractor's Engineer and be considered incidental to this item. The waterproofing system design shall comply with CSPI Technical Bulletin 31.

For open bottom structures, the footing design shall be as shown on the project drawings. There shall be no modification to the geometry or configuration of the reinforced concrete footings without written approval from the Engineer of Record responsible for the substructure design. The review and acceptance of the structural plate structure shop drawings shall not be misconstrued as acceptance of any substructure modifications. Acceptance of any changes to the substructure proposed by the soil-metal structure designer shall be at the sole discretion of the Engineer of Record for the substructure.

426.04 SUBMITTALS

426.04.01 General Requirements

The Contractor shall submit in a timely fashion all shop drawings, water testing results and design calculations. Drawings shall clearly show the dimensions of all components, materials, thicknesses, and special details. Drawings shall also detail the backfill specifications, gradation, extents and backfilling procedures to be followed. Following

acceptance of these submittals by the Department, the issued for construction drawing set and design calculations shall bear the stamp of a Professional Engineer licensed to practice in the Province of Newfoundland and Labrador. Calculation submittals shall meet the requirements stipulated in Section 927.

The Department requires a minimum of 2 weeks to review submitted documents. The Department's review period shall not commence until the shop drawings, design calculations and water testing results have been submitted to the Department. All issued for construction submittals shall be received 2 weeks prior to the start of construction.

Any changes, deletions, omissions etc. to the Department's specifications shall be highlighted with each submission, with each instance specifically stated and explained for consideration by the Owner's Representative.

The Contractor is reminded of General Condition 41.3 and their responsibility to review, stamp, date and sign all submittals. Prior to the submission of shop drawings, calculations and other submittals, all documents must be reviewed by both the Contractor and the Contractor's Engineer to ensure that the Department receives a compliant submission. The Department will not review a submittal which does comply with the above requirement.

All submittals pertaining to the structure design shall be received, reviewed and accepted by the Department prior to fabrication of the structure.

Once submittals are accepted by the Department then no changes can be made by the Contractor, Contractor's Engineer, nor the Engineer of Record without the submission of such changes and written approval from the Owner's Representative acknowledging acceptance of such changes.

All drawings and technical specifications shall be in accordance with PEGNL's "Guideline for preparation of Engineering and Geoscience Drawings and Technical Specifications".

The manufacturer shall provide a copy of the plant certificate of conformance for Corrugated Steel Structures. The manufacturer's plant certificate of conformance shall be issued by an independent 3rd party certification agency who is accredited by the Standards Council of Canada, confirming that the manufacturer produces certified corrugated steel pipe products in accordance with CSA G401.The structure shall have two identifier plates attached to the upper ends of the structure or individual plates containing the Certifying Agency's logo, manufacturer name, serial / project number and supply year.

Mill certificates for the material, as well as other Quality Assurance documentation related to the design and fabrication of the structure shall be available upon request.

Following the installation of the long span structural plate structure, including all backfilling, the manufacturer/designer shall provide a letter of conformance indicating, unequivocally, that the structure has been installed in accordance with all specifications and design requirements. The manufacturer/designer must review all quality control documentation, correspondence, other relevant documentation and preform site inspections during construction, as required by their quality management system to verify the installation. The Letter of Conformance shall be stamped by the Engineer of Record for the LSSPS design who must be a Professional Engineer licenced to practice in Newfoundland and Labrador.

426.04.02 Quality Control Plan

The Contractor shall submit to the Department a Quality Control Plan which ensures conformance with the requirements stipulated by the manufacturer, designer, CAN/CSA S6, CSA G401 and the Contract Documents.

The Department requires a minimum of 2 weeks to review the Quality Control Plan. The Contractor's finalized Quality Control Plan must be submitted minimum of 2 weeks prior to construction.

No work shall commence until the Contractor's Quality Control Plan has been reviewed and accepted by the Department.

The Contractor's Quality Control Plan shall bear the stamp of a Professional Engineer licensed to practice in the Province of Newfoundland and Labrador.

At a minimum the Contractor's Quality Control Plan shall include the following:

426.04.02.01 Bolt Torque Testing

The Contractor shall include in their Quality Control Plan a procedure that ensures that assembly and erection is in accordance with latest version of CAN/CSA S6, with the following exception:

426.04.02.01.01 Initial Assembly

The torque on all bolts prior to backfilling shall be in accordance with ASTM A807/807M for steel structures and ASTM B789/789M for aluminum structures. A minimum of 10%

of all bolts shall be tested after assembly. The tested bolts shall be randomly selected and the bolted assembly shall only be accepted if at least 90% of bolts test above the torque requirement.

Should the tested bolts not meet the 90% threshold stated above, then the Contractor shall randomly select 50% of the remaining untested bolts for additional testing. The bolted assembly shall only be accepted if at least 90% of the additional bolts tested satisfy the torque requirement. Otherwise, the Contractor shall re-torque all bolts.

Failure to obtain written acceptance of the initial assembly bolt torque testing results, prior to commencing backfill operations, shall result in the immediate rejection of the entire plate assembly.

426.04.02.01.02 During Backfill Operations

Upon acceptance of the initial assembly bolt torque testing results by the Department, backfilling operations may commence in accordance with Section 426.09.02.

During the backfilling operation a minimum of 5% of the bolts shall be randomly selected for testing. Testing shall be carried out as backfilling progresses and shall include the bolts which are exposed (above the current level of backfill at the time of testing). Bolts shall be randomly selected and the bolted assembly shall only be accepted when at least 90% of the bolts tested satisfy the torque requirement.

Should the tested bolts not meet the 90% threshold stated above, then the Contractor shall randomly select 25% of the remaining bolts for additional testing. The bolted assembly shall be accepted if at least 90% of the additional bolts tested satisfy the torque requirement. Otherwise, the Contractor shall re-torque all bolts, or as directed by the Owner’s Representative.

426.04.02.01.03 Bolt Testing Results

All bolt testing results shall be provided to the Owner’s Representative as they become available. Bolt testing from initial assembly must be submitted and accepted by the Owner’s Representative prior to commencing backfilling operations.

Bolt torque results must be signed by the Contractor’s Representative and include: date, time, location, equipment used and height of backfill.

426.04.02.02 Shape Monitoring

The Contractor must detail in their Quality Control Plan a procedure for monitoring shape throughout construction. Deflections from the specified dimensions shall be within the

tolerances permitted by the soil-metal structure designer. Acceptable shape monitoring tolerances for the specific structure must be clearly shown in the Quality Control Plan and Shop Drawings.

All surveying shall be non-destructive in nature. No permanent alterations shall be made to the structure as part of this quality control activity.

All shape monitoring results shall be provided to the Owner's Representative as they become available. Shape monitoring results must be signed by the Contractor's Representative and include: date, time, location and equipment used.

426.04.02.03 Backfill Testing and Compaction

The Contractor's material testing, backfilling and inspection plan must be detailed in their Quality Control Plan. Select Backfill quality control procedures shall be compliant with Section 411.

All material testing requirements, testing methods, and frequency of testing for the select backfill material shall be clearly identified.

All equipment being used in backfilling operations must be listed. Maximum backfill lift thickness must be identified.

All details are to be provided on construction loading; including minimum heights of cover during construction and the use of any specific equipment and weights being utilized.

The backfilling and inspection plan shall indicate which third party geotechnical engineering consultant has been engaged to certify select backfill compaction. The plan shall also include the method and frequency by which the compaction is being tested.

All backfill material testing shall be promptly provided to the Owner's Representative as they become available. Backfill operations shall not commence until all material testing is complete and is accepted by the Department.

Compaction testing must be promptly provided to the Owner's Representative as the backfilling operations progress.

A comprehensive summary testing package, including all relevant material, electrochemical, and compaction tests, shall be submitted to the Department for its records. This package must be stamped and certified by the Contractor's Geotechnical Engineer of Record.

426.04.02.04 Manufacturer's Installation and Best Practices Manual

The Manufacturer's Installation/Best Practices Guide shall form part of the Contractor's Quality Control Plan.

426.04.02.05 Handling, Shipping and Storage

As part of the Quality Control Plan the Contractor must detail the transportation, handling and storage methods for the structure. The methodology must be shown to be in conformance with the manufacturer's recommendations.

426.04.02.06 Letter(s) of Conformance

The Contractor's Quality Control Plan shall list all letters of conformance which are required to be submitted to the Department. These include, but are not limited to:

- Manufacturer's Plant Certificate of Conformance
- Contractor's Geotechnical Engineer's Letter of Conformance (Materials Testing)
- Contractor's LSSPS Designer's Letter of Conformance (Material Testing) Contractor's Geotechnical Engineer's Letter of Conformance (Compaction)
- Contractor's LSSPS Designer's Letter of Conformance (LSSPS Structure Installation)

426.04.02.07 Material on Site

The Contractor's Quality Control Plan must include details to demonstrate conformance with Section 426.06 of this Specification.

As part of this procedure the Contractor must ensure that structure materials are made available and fully visible to the Owner's Representative for inspection and initial acceptance. The Contractor is advised that final acceptance of the structure material will only be given once the structure is completely installed and backfilled.

426.04.03 Quality Control Reporting

All quality control documentation shall be provided to the Department as the project progresses. Documentation shall include, but is not limited to: structure alignment/shape monitoring, bolt torque testing, material testing, and compaction testing. Failure to provide this information shall result in the issuance of a stop work order. Delays resulting from the failure to submit quality control documentation shall not form the basis of any claim.

Quality control reporting shall be promptly provided as the installation progresses.

As a minimum, the Contractor is required to submit a daily work report for each day that work is performed on-site. The report must summarize the following: a description of the work completed, the equipment utilized and present on-site, any significant issues or challenges encountered, and any quality control test results conducted during the day. The report must also include photographic documentation of the ongoing work activities, with the images clearly illustrating the progress made and specific tasks completed on that day. Additionally, the daily report must be dated and signed by the Contractor's Representative, verifying the accuracy of the information provided. Reports must be submitted to the Owner's Representative no later than the following morning to ensure timely review and record-keeping.

Failure to submit quality control reporting in a timely manner shall result in a 10% holdback on the Long Span Structural Plate Structure, until such time that the required reports have been submitted to, and accepted by, the Owner's Representative.

426.04.04 List of Required Submittals

To ensure proper documentation and conformance, the following items must be submitted by the Contractor at the specified stages of the installation. At a minimum the required submittals include, but are not limited to the following:

- Structure Shop Drawings
- Design Calculations
- Water Testing Results
- Quality Control Plan
- Manufacturer's Plant Certificate of Conformance
- Bolt Torque Testing Results
    - Initial Assembly
    - During Backfill
- Structure Alignment/Shape Monitoring Testing Results
- Daily Quality Control Reporting
- Backfill Material Testing Results (Gradation and Electrochemical)
    - Backfill Sample Provided to Owner's Representative
- Contractor's Geotechnical Engineer's Letter of Conformance (Materials Testing)
- Contractor's LSSPS Designer's Letter of Conformance (Material Testing) Backfill Material Testing Results (Compaction)
- Contractor's Geotechnical Engineer's Letter of Conformance (Compaction)
- Comprehensive Summary Testing Package
- Contractor's LSSPS Designer's Letter of Conformance (LSSPS Structure Installation)

426.05 ENVIRONMENTAL PERMITS AND AUTHORIZATIONS

Authorization from the Department of Fisheries and Oceans Canada's Fish and Fish Habitat Protection Program is required for work in or near any watercourse or water body deemed to be viable fish habitat.

Work is to be carried out in accordance with all requirements stipulated by regulatory agencies whose approval is required. This includes, but is not limited to, the Department of Fisheries and Oceans Canada, Transport Canada's Navigation Protection Program and the Water Resources Division of the Department of Environment, Climate Change and Municipalities.

Unless otherwise specified in the contract documents, where unwatering is required, the Contractor shall carry out this work in accordance with Section 180 "Unwatering Incidental to Work".

The Contractor shall be aware of the requirements of Division 8.

426.06 MATERIALS

426.06.01 Fabrication

Structural components shall be carefully formed to the corrugation profile and curved to the required radius along the inner crest, in the manufacturer's plant.

Fabrication of all components must meet the requirements of CAN/CSA G401 or ASTM A761, as applicable.

426.06.02 Materials for Steel Structures

Steel plate to conform to the latest version of CSA G401.

Corrugated steel structural plate shall meet the general requirements as specified in CSA G401.

For galvanized structures, a zinc coating shall be applied after fabrication. The coating must provide a minimum coating weight of 915 grams per square metre total on both sides of the corrugated steel plates and base channels in accordance with CSA G401.

For thermoplastic copolymer coated structures, a thermoplastic copolymer coating shall be applied to both sides of the corrugated steel plates and base channels in accordance with CSA G401.

Bolts and nuts for the structural plate connections shall be heavy hex, meeting the requirements of CSA G401. Anchor bolts shall meet CSA G401. All fasteners and anchor bolts shall be zinc coated in accordance with CSA G401.

For thermoplastic copolymer coated structures all fasteners shall be in accordance with the latest version of CSPI Technical Bulletin Issue Twenty-Three.

Steel for base channels, if required, to conform to CSA G401.

Backfill requirements shall be in accordance with Section 411.

426.06.03 Materials for Aluminum Structures

Aluminum plates to conform to the latest version of ASTM B746.

The aluminum structural plate shall meet the general requirements as specified in ASTM B746. Bolt holes shall be 25 millimetres in diameter using 19 millimetre diameter (3/4”diameter) bolts.

Bolts and nuts for the structural plate connections shall be heavy hex.

Steel bolts shall meet the requirements of CSA G401. Anchor bolts shall meet CSA G401.

All fasteners and anchor bolts shall be coated in accordance with CSA G401.

Aluminum bolts shall meet the requirements of ASTM F468, made from Alloy 6061-T6.

Aluminum nuts shall meet the requirements of ASTM F467, made from alloy 6061-T6.

Backfill requirements shall be in accordance with Section 411.

426.07 HANDLING, SHIPPING AND STORAGE

The Contractor shall be responsible for the acceptance, unloading, handling, and storage of all material delivered to the project site. All components shall be handled, stored and shipped in such a manner as to eliminate the potential for damage as detailed in the manufacturer’s installation guide. All damaged components shall be rejected by the Department and replaced at the Contractor’s expense. Any loss or damage to material after acceptance shall be replaced by the Contractor at their own expense. Damaged components shall include, but is not limited to, any structural plates which exhibit permanent deformation or strain.

Stockpile lay down areas shall be specified by the Contractor prior to the start of construction and will be subject to the approval of the Owner's Representative. Stockpile locations shall be at or near the project site.

The stockpile lay down areas shall not impact the operation and/or access to utilities, including but not limited to power lines, waterlines, and underground utilities. The Contractor shall acquire any required approvals, clearances, or permits for stockpile lay down areas prior to the start of construction. Work is to be carried out in accordance with all requirements stipulated by regulatory or utility agencies whose approval is required. This includes, but is not limited to, the Department of Fisheries and Oceans Canada and the Water Resources Division of the Department of Environment and Climate Change. The Contractor shall be aware of the requirements of Division 8.

Stockpile lay down areas shall be cleaned of any debris and objectionable material by the Contractor prior to placing the material. This cleaning shall be considered incidental to the work. Stockpile lay down areas shall have a uniform smooth surface and be graded to ensure positive drainage away from the stockpile materials.

For any stockpile lay down areas on private property, the Contractor shall obtain a signed agreement with the property owner prior to the start of construction. This agreement shall be submitted to the Owner's Representative for review and approval at minimum ten (10) working days prior to the start of construction.

Structural plate and any other fabricated material shall be stored at least 150 mm above ground level, in an organized fashion, and be supported to prevent any permanent deformation, in a manner acceptable to the Owner's Representative. Structural plates and fasteners shall be stored in accordance with CSPI Technical Bulletin 28. For the purposes of this specification, long term storage is defined as a period exceeding 3 months or for material stored over the Winter Season (December to May). Stockpiled material must be protected from environmental damage and corrosion, in a manner acceptable to the Owner's Representative. For long term storage, the Contractor shall provide a detailed storage plan to the Owner's Representative for their review and acceptance. The Contractor shall adhere to any additional storage requirements specified by the manufacturer or as directed by the Owner's Representative.

The Contractor shall be responsible for providing any and all required security to prevent loss or damage to stockpiled materials. Any lost or damaged stockpiled material shall be replaced by the Contractor at their own expense.

426.08 EXCAVATION

The Contractor shall excavate the foundation area within the limits required to complete the LSSPS Installation. Excavation for foundation shall be carried out and paid for in accordance with Section 403.

Closed Bottom Structures:

The foundation excavation shall be 300 millimeters below the proposed invert grade. The width shall be equal to the width of the proposed structural plate pipe or pipe-arch, plus half the span on each side, or as specified in the LSSPS shop drawings. The excavation shall extend from the bottom of the outside excavation limits to the existing grade, with a 1.5:1 slope.

Open Bottom Structures:

The foundation excavation shall extend to the underside of the foundation system. The width shall be equal to the width of the proposed structural plate arch, plus half the span on each side, or as specified in the LSSPS shop drawings. The excavation shall extend from the bottom of the outside excavation limits to the existing grade, with a 1.5:1 slope.

426.09 ASSEMBLY AND BACKFILLING

426.09.01 Assembly

For open bottom structures, the Contractor shall construct footings for the structure on suitable foundation soils as approved by the Owner's Geotechnical Engineer. The footings must be accurately located as shown on the drawings. If base channels are required, the channel shall be attached to the footing as detailed on the manufacturer’s shop drawings.

The Contractor shall allow the concrete footings to cure for at least three days before commencing the assembly of the structural plate and the bolting of the plates to the base channel embedded in the footing.

The Contractor shall be responsible for the provision and use of survey equipment required to complete and verify footing layout.

Plates shall be bolted at longitudinal and circumferential seams such that no more than 3 plates overlap at any bolt hole on the main barrel.

The cutting or drilling of holes in new structural plates in the field is not permitted without the Owner's written approval. On a case-by-case basis, the Contractor shall submit to the Department a detailed request to modify structural plate, which includes but is not limited to: drilling, cutting etc. Requests of this nature must also be accompanied by a manufacturer/designer approved repair procedure.

Any defective plates must be reported to the supplier and corrective action taken by the supplier or manufacturer.

Any damage to metallic coatings shall be repaired in accordance with the latest version of CSA G401. With the following exception; an individual structural plate shall be rejected by the Department for either of the following:

- If an individual uncoated/damaged area exceeds 300mm in any one dimension.
- If an individual uncoated/damaged area exceeds 50mm in both dimensions.
- If the total combined uncoated/damaged surface area measures more than 1% of the total surface area.

In any of the above cases the Contractor may propose an engineered repair plan for consideration by the Department. If the Department elects not to accept the engineered repair plan, the structural plate shall be replaced with new material, or be re-dipped in accordance with CSA G401. The acceptance of the repair procedure shall be at the sole discretion of the Department.

Any damage to polymer coatings shall be promptly repaired in accordance with CSA G401 and CSPI Technical Bulletin Number Two. With the following exception; an individual structural plate shall be rejected by the Department for either of the following:

- If an individual uncoated/damaged area exceeds 300mm in any one dimension.
- If an individual uncoated/damaged area exceeds 50mm in both dimensions.
- If the total combined uncoated/damaged surface area measures more than 1% of the total surface area.

In any of the above cases the Contractor may propose an engineered repair plan for consideration by the Department. If the Department elects not to accept the engineered repair plan, the structural plate shall be replaced with new material, or be re-coated in accordance with CSA G401. The acceptance of the repair procedure shall be at the sole discretion of the Department.

All costs associated with preparation of repair procedures and repairing or replacing the damaged structural plate structure components shall be borne entirely by the Contractor.

The LSSPS Manufacturer shall provide the Contractor with a comprehensive overview of the installation manual and shall offer instruction on the correct procedures for assembly, backfilling, and shape control/monitoring.

The Contractor shall assemble and install the structure in accordance with the accepted issued for construction shop drawings, the manufacturer's installation guide, and all applicable specifications.

Any Issues with the installation shall be immediately brought to the Owner's Representative.

The Contractor is responsible for quality control for the Long Span Structural Plate Structure installation.

Backfilling shall not commence until footings and any concrete headwalls and wing walls have cured to at least 70% of the specified design strength at 28 days, or cured for seven days, whichever comes first. This requirement may be increased by the Engineer of Record for the reinforced concrete components.

Backfill shall be carefully placed and compacted so that the correct shape of the structure is maintained. The Contractor shall monitor the shape of the structure during backfilling operations. Any deflection from the specified dimensions shall be within the tolerances noted on the manufacturer's shop drawings. If deflections exceed the permitted tolerances, then backfilling operations shall be ceased until a suitable procedure is developed by the Contractor and approved by the LSSPS manufacturer/designer or the structural components are replaced at the Contractor's expense. The manufacturer and Owner's Representative shall be notified in writing immediately of any deflections that are in excess of the permitted tolerances.

All structural plates which exhibit permanent deformation or strain for any reason shall be reject by the Department and replaced at the Contractor's expense.

426.09.02 Backfilling

Backfilling shall be carried-out in accordance with Section 411.

Upon request by the Department, where the Contractor is procuring select backfill material from a third party, the Contractor shall provide proof of delivery for all select backfill material.

426.10 PROTECTION FROM TRAFFIC

Prior to allowing the movement of construction equipment or any vehicular traffic over the structure, the depth of cover over the structure shall not be less than the manufacturer's recommended minimum cover for the particular loading condition as stated on the manufacturer's Issued for Construction Shop Drawings. Any construction equipment exceeding CL-625 loading conditions shall not be permitted over the structure.

426.11 MEASUREMENT FOR PAYMENT

Measurement for payment for the design, supply and installation of the long span structural plate structure shall be the actual length of the installed plate structure, as shown on the shop drawings. The measurement shall be computed in metres, rounded to one decimal place.

426.12 BASIS OF PAYMENT

Payment at the contract price for the design, supply, and installation of the long span structural plate structure shall be compensation in full for all materials, labour, and use of equipment to: complete water testing, design, supply, transport, assemble, and install the structure, provide any required unwatering, complete all quality control measures, supply, place, compact and test the backfill in accordance with Section 411 together with the provision of professional engineering services.

Included in the materials which shall be supplied by the Contractor are all plates, base channels, nuts, bolts, and washers, distribution slabs, ribs and gaskets, select backfill and such other items which may be included in the design.

If the structure is intended to convey through traffic, then the design, supply and installation of a waterproof membrane, as specified by the Contractor's Engineer, shall be included and considered incidental to this item.

Should the water test results yield conditions more aggressive than that listed in Table 7 of the CSPI Technical Bulletin 13 for aggressive corrosivity classification, at the discretion of the Department, the structure shall receive a thermoplastic copolymer coating, payment for the coating shall be at the invoice cost from the supplier +10%. An original invoice from the supplier shall be provided to the Department prior to payment.

Payment for the long span structural plate structure, including materials, will only be made once the structure is installed, backfilled and all letters of conformance have been received and accepted by the Department. No interim payments will be considered.

Contractors are advised that any failure to fully comply with all specified requirements, including but not limited to the timely submission of documentation, completion of necessary material testing, and adherence to all quality control protocols and requirements as outlined in this specification, shall result in the unconditional rejection of the structural plate installation. This decision will be made at the sole discretion of the Department, and no further consideration for acceptance or approval of the installation will be given.

SECTION 430

SCREEN END TREATMENT FOR CORRUGATED STEEL PIPE

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430.01 SCOPE

This specification covers the requirements for the supply and installation of a screen to the end of a corrugated steel pipe culvert or to the inlet of a corrugated steel pipe (CSP) storm sewer.

430.02 MATERIALS

Screens shall consist of 3.8 millimetre galvanized steel mesh welded to a standard pipe coupling of such size as to fit the size of pipe for which the screen is required. A drawing of a typical screen is shown on Form 1225.

Coupler, nuts and bolts shall be composed of galvanized steel.

After fabrication, the screen shall be rust proofed with cold galvanizing compound.

When corrugated steel pipe is cut, drilled, or welded the pipe shall be thoroughly cleaned with a wire brush to remove scale, rust, slag residue, weld splatter, etc., and wiped clean. The cleaned surface shall receive at least one application of metal conditioner to de-oxidize, de-grease, and phosphatize the metal surface to be treated if the surface is oily. Premixed, ready-to-apply, liquid-zinc compound should be applied to the prepared clean dry metal surface. The cold-galvanizing compound must be of a type that imparts cathodic action against corrosion. The cold-galvanizing compound should have a minimum 50 millimetre overlap of the surrounding undamaged galvanized metal.

All cut edges and any damage to metallic coatings shall be ground smooth and recoated in accordance with CSA G401.

All materials including: steel mesh, pipe coupling, cold galvanizing compound, nuts and bolts shall be supplied by the Contractor.

430.03 FABRICATION AND INSTALLATION

The screen shall be fabricated to such size that it will fit over, and be capable of being secured to the CSP for which it is required. The screen shall be constructed as shown in the drawings and then rust proofed as outlined above.

After all treatments are thoroughly dry, the screen shall be securely bolted to the end of the corrugated steel pipe.

430.04 MEASUREMENT FOR PAYMENT

Measurement for payment for screen and treatment for corrugated steel pipe shall be by the number of screen end treatments of a particular size and type installed.

Screen end treatment sizes are specified in the unit price table in terms of the size of the pipes to which they will be connected.

430.05 BASIS OF PAYMENT

Payment at the contract price for each screen end treatment of the type and size specified shall be compensation for all labour, materials, and equipment use required to: supply the steel mesh and pipe coupling, to fabricate and rust proof the screen as outlined above, to supply nuts and bolts, and to secure the screen to the corrugated steel pipe, together with such unwatering provisions as may be necessary to carry out the work.

SECTION 440

CLEANOUT OF EXISTING CULVERTS

INDEX

440.01 GENERAL

Existing culverts to be cleaned out will be identified in the field by the Owner's Representative. The conditions of the site and the existing culverts shall be thoroughly assessed by the Contractor prior to the commencement of work, including the degree of pipe blockage and types of debris. Cleaning of existing culverts shall typically be accomplished by means of high velocity jet water propelled cleaning equipment. The equipment, nozzles, flow rates, and pressures necessary to complete the work shall be determined by the Contractor. The equipment shall be able to clear blockages and remove debris from pipe sewer systems with varied sizes and downstream constraints. If necessary, and as directed by the Owner's Representative, other means of culvert cleaning such as hand cleanout, hydraulically propelled or mechanically powered cleaning equipment with use of reamers, cutters or grinders, and flushed afterwards with a high-pressure water nozzle shall be utilized.

Pipe culverts shall be cleaned to the bottom face of the pipe, open bottom culverts shall be cleaned to the level of the top of footing, and concrete box culverts shall be cleaned to the bottom slab, unless otherwise directed by the Owner's Representative or specified in the Contract Documents. The culvert shall be considered clean when all debris, including vegetation at the inlet and outlet that obstructs the flow, sand or silt has been removed from the top, side and bottom (invert) of the culvert.

The Owner's Representative shall be notified of the location where cleaning will be performed a minimum of 24 hours in advance of commencing the work.

The Contractor shall ensure that cleaning operations do not damage the existing condition of the culverts. During cleaning operations the Contractor shall identify any areas of deterioration or damage and immediately notify the Owner's Representative. Water pressures and flow volume shall be appropriate for the age and condition of the existing culvert, and shall not cause damage to the culvert. Existing culverts damaged as a result

of negligence on behalf of the Contractor shall be repaired at the Contractors expense. The Contractor is responsible for ensuring that cleanout operations do not cause flooding or damage to adjacent private properties. Any damage to the existing culverts or private property arising from cleanout operations shall be repaired at the Contractor's expense.

Cleanout shall include the removal and disposal of any debris, blockages, or any build-up of foreign material that may be obstructing the existing culvert at or immediately adjacent to the culvert's inlet and outlet. Any and all debris resulting from the cleaning operations shall be removed from the job site and properly disposed of by the Contractor, at their own expense. If debris accumulates in clean drainage infrastructure during construction, the Contractor shall clean the culvert again, at their own expense.

The Contractor shall provide unwatering as required to clean existing culverts in the dry. Unwatering shall be carried out as specified in Section 180 of the Department's Specifications Book. The watercourse shall be protected from the entry of any sediment or debris disturbed from the work. Removed sediment and debris shall be captured and collected by the Contractor as part of the work. Where sediment control measures are found to be insufficient, the contractor shall make immediate corrections to the control measures.

Before cleaning operations the Contractor shall remove and store all grates and other appurtenances from the culvert. When cleaning is complete, treat hardware required for the grates and other appurtenances with anti-seize compound. Then, reinstall the grate and appurtenances using the treated hardware.

While cleaning existing culverts, the road surface above the culvert shall be monitored for any visual signs that pavement or embankment sinkholes are developing. If sinkholes are suspected, all work shall stop immediately and the Owner's Representative must be notified.

Water source shall be as specified by the Contractor. Water shall be clean and free from oil, acid, alkali, organic matter, or other deleterious substances. Backflow prevention and air gap methods shall be used when water is taken from potable water systems, and shall be considered incidental to the work.

All work shall be carried out in accordance with Division 8 of the Department's Specifications Book.

440.02 MEASUREMENT OF PAYMENT

Measurement of payment for the cleanout of existing culverts shall be the length of culvert/pipes cleaned, measured in linear meters, rounded to one decimal place.

440.03 BASIS OF PAYMENT

Payment at the contract price shall be considered compensation in full to: provide all materials, labour, supervision and equipment required to cleanout existing culverts as required by the Owner's Representative.

Disposal of all materials collected from culvert cleanout shall be disposed of offsite at the Contractor's Expense.

SECTION 441

CLEANOUT OF EXISTING STORM SEWERS, CATCH BASINS, MANHOLES AND DITCH INLETS

INDEX

441.01 GENERAL

Storm sewers, catch basins and ditch inlets to be cleaned out will be identified in the field by the Owner's Representative. The conditions of the site and the storm sewer system shall be thoroughly assessed by the Contractor prior to the commencement of work, including the degree of pipe blockage and types of debris. Storm sewer cleanout shall typically be accomplished by means of high velocity jet water propelled cleaning equipment. The equipment, nozzles, flow rates, and pressures necessary to complete the work shall be determined by the Contractor. The equipment shall be able to clear blockages and remove debris from pipe sewer systems with varied sizes and downstream constraints. If necessary, and as directed by the Owner's Representative, other means of storm sewer cleaning such as hand cleanout, hydraulically propelled or mechanically powered cleaning equipment with use of reamers, cutters or grinders, and flushed afterwards with a high-pressure water nozzle shall be utilized. Cleanout operations shall restore the existing infrastructure to within 25mm of its original internal diameter.

The Owner's Representative shall be notified of the location where cleaning will be performed a minimum of 24 hours in advance of commencing the work.

The Contractor shall ensure that cleaning operations do not damage the existing condition of the storm sewers. During cleaning operations the Contractor shall identify any areas of deterioration or damage and immediately notify the Owner's Representative. Water pressures and flow volume shall be appropriate for the age and condition of the storm sewer system, and shall not cause dame to the storm sewer. Storm sewer infrastructure damaged as a result of negligence on behalf of the Contractor shall be repaired at the Contractors expense. The Contractor is responsible for ensuring that cleanout operations do not cause flooding or damage to adjacent private properties. Any damage to the existing storm sewer or private property arising from cleanout operations shall be repaired

at the Contractor's expense. Cleanout of the storm sewer shall not cause any blockages to service connections or laterals.

Cleanout shall include the removal and disposal of any debris, blockages, or any build-up of foreign material that may be obstructing the storm sewer infrastructure at or immediately adjacent to the inlet and outlet. Any and all debris resulting from the cleaning operations shall be removed from the job site and properly disposed of by the Contractor, at their own expense. If debris accumulates in clean drainage infrastructure during construction, the Contractor shall clean infrastructure again, at their own expense

Storm sewers shall be cleaned in the direction of flow for each segment of storm sewer. The Contractor shall install a screen at all storm sewer outfalls to collect all materials that migrate downstream from the given section of storm sewer cleanout. Precautions shall be taken to ensure that no foreign material, silt laden or contaminated cleanout water enters any adjacent watercourses at storm sewer outfalls.

Before cleaning operations the Contractor shall remove and store all grates and other appurtenances from the culvert. When cleaning is complete, treat hardware required for the grates and other appurtenances with anti-seize compound. Then, reinstall the grate and appurtenances using the treated hardware.

Water source shall be as specified by the Contractor. Water shall be clean and free from oil, acid, alkali, organic matter, or other deleterious substances. Backflow prevention and air gap methods shall be used when water is taken from potable water systems, and shall be considered incidental to the work.

Contractors are reminded that all relevant sections of Division 8 – General Environmental Requirements of the Department's Specifications Book shall apply to this work.

441.02 MEASUREMENT OF PAYMENT

Measurement for payment for the cleanout of existing storm sewer pipe of a particular diameter shall be the length of storm sewer pipe cleaned out, measured in meters, rounded to one decimal place.

Measurement for Payment for the cleanout of existing storm sewer catch basins, manholes and ditch inlets of a particular size shall be measured per each individual unit cleaned out.

441.03 BASIS OF PAYMENT

Payment at the contract price shall be considered compensation in full to: provide all materials, labour, supervision and equipment required to cleanout existing storm sewer culverts, catch basins, manholes and ditch inlets as required by the Owner's Representative.

Disposal of all materials collected from storm sewer cleanout shall be disposed of offsite at the Contractor's Expense.

SECTION 450

CONCRETE FOOTINGS FOR STRUCTURAL PLATE STRUCTURES

INDEX

450.01 SCOPE

This specification covers the Department's requirement for the construction of concrete footings for structural plate arches and long span structural plate structures. The footings incorporating a base channel, reinforcing steel, and dowels if required, shall be as shown on the drawings, or as directed by the Owner’s Representative.

Dowels where required, shall be a separate contract item.

Where unwatering is required, it shall be carried out as specified in Section 180.

450.02 MATERIALS

450.02.01 Base Channel

The Contractor will supply the base channel sections. Base channels are supplied and paid for under Section 424 or Section 426, as appropriate.

450.02.02 Concrete

Concrete shall meet all requirements for “Substructure, Reinforced Wharf Deck, Cast-In-Place Median & Precast Traffic Barrier” concrete, in accordance with Section 904.

450.02.03 Reinforcing Steel

Reinforcing steel shall be of the sizes shown in the drawings. Reinforcing steel shall conform to the requirements of Section 905

450.03 EXCAVATION

The Contractor shall excavate a foundation within the limits and to the grades as staked by the Owner’s Representative.

The excavation shall be carried out and paid for in accordance with Section 403.

450.04 FORMWORK

Before placing formwork, the Contractor shall have drilled the required holes removed any dirt and debris that may be in the holes with compressed air or other acceptable means, inserted the required dowels, free of oil, grease, excessive rust and scale, and grouted them securely in place where the contract documents indicate that dowels are required. Holes to be drilled into the rock for the insertion of dowels shall have a maximum size of 1.5 to 2 times the dowel diameter.

Formwork shall be supplied by the Contractor, and shall conform to the requirements of Section 907.

450.05 PLACING OF REINFORCING STEEL

Reinforcing steel shall be placed in accordance with the requirements of Section 905.

450.06 PLACING CONCRETE AND CHANNEL

The Contractor shall load the channel sections at the point of supply and transport them to the installation site.

The lugs on the channels shall be bent down and twisted into the correct position.

The channels shall be placed in the footings to the lines and grades indicated on the plans and shop drawings.

Concrete shall be placed in accordance with the requirements of Section 904.

As soon as the concrete has been placed and consolidated, it shall be struck off true to grade on each side of the imbedded channel.

The surface shall then be floated with a wooden float until the mortar flushes to the top, and the entire surface, on each side of the channel, presents a tight and compact appearance.

450.07 CURING THE CONCRETE

Concrete shall be cured in conformity with the requirements of Section 904.

450.08 TRIMMING

After the removal of the forms and after the initial curing of the concrete, the Contractor shall backfill adjacent material into any foundation trenches which may occur at the ends and at the stream sides of the footings. The ground next to the ends and the stream sides of the footings shall be made trim to sightly proportions.

450.09 MEASUREMENT FOR PAYMENT

Measurement for payment for Concrete Footings for Structural Plate Structures shall be calculated from the dimensions of the footings as laid out according to the instructions of the Owner’s Representative and such measurements will be computed to obtain the volume in cubic metres, rounded to two decimal places.

450.10 BASIS OF PAYMENT

Payment at the contract price for Concrete Footings for Structural Plate Structures shall be full compensation for all labour, materials, and equipment use: to supply and place formwork, to supply reinforcing steel, to protect and clean the reinforcing steel as required, to bend, cut and weld the reinforcing steel, to place the reinforcing steel in the work, to support the reinforcing steel during the placing, to supply and place concrete, to cut and place channel sections, to cure the concrete, to remove the forms and to trim the adjacent ground; together with labour, materials, and equipment use to provide such unwatering provisions that may be necessary in order to carry out the work according to these specifications.

It should be clearly understood, that the supply of the reinforcing steel is included in the basis of payment for Concrete Footings for Structural Plate Structures.

Dowels, where required, shall be compensated for in a separate contract item.

450.11 CONCRETE ACCEPTANCE AND REDUCED PAYMENT CRITERIA ON CONCRETE FOOTINGS FOR STRUCTURAL PLATE STRUCTURES

Concrete footings and headwalls, as defined by the contract item and the required specified strength at 28 days, must have an average tested strength at 28 days equal to or greater than that specified for payment at the bid price.

Concrete of a lower strength will have Section 904.11.03 apply for adjustment of the unit price applicable or judgement of the acceptability of the concrete placed for this item.

SECTION 451

CONCRETE HEADWALLS FOR STRUCTURAL PLATE STRUCTURES

INDEX

451.01 SCOPE

This specification covers the Department's requirements for the construction of concrete headwalls for structural plate pipes, pipe-arches, arches, and long span structural plate structures. The headwalls, incorporating galvanized anchor bolts and reinforcing steel, shall be as shown on the drawings, or as directed by the Owner’s Representative.

Where unwatering is required, it shall be carried out as specified in Section 180.

451.02 MATERIALS

451.02.01 Galvanized Anchor Bolts

The Contractor shall supply all galvanized anchor bolts and associated hardware required to anchor the concrete headwall to the structural plate structure. Supplied anchor bolts and associated hardware shall meet the specification of the structural plate structure designer.

451.02.02 Concrete

Concrete for use in constructing the headwalls shall be supplied by the Contractor and shall meet the specification for “Substructure, Reinforced Wharf Deck, Cast-in-Place Median & Precast Traffic Barrier” concrete, in accordance with Section 904.

451.02.03 Reinforcing Steel

Reinforcing steel shall be of the sizes shown in the drawings.

Reinforcing steel shall conform to the requirements of Section 905.

451.03 FORMWORK

Formwork shall be supplied by the Contractor, and shall conform to the requirements of Section 907.

451.04 PLACING OF REINFORCING STEEL

Reinforcing steel shall be placed in accordance with the requirements of Section 905.

451.05 PLACING CONCRETE AND GALVANIZED ANCHOR BOLTS

Concrete shall be placed in accordance with the requirements of Section 904.

Anchor bolts shall be installed as detailed on the for construction drawings.

451.06 CURING THE CONCRETE

Concrete shall be cured in conformity with the requirements of Section 904.

451.07 MEASUREMENT FOR PAYMENT

Measurement for payment for Concrete Headwalls for Structural Plate Structures shall be calculated from the dimensions of the headwalls as laid out in accordance with the contract drawings and such measurements will be computed to obtain the volume in cubic meters, rounded to two decimal places.

451.08 BASIS OF PAYMENT

Payment at the contract price for Concrete Headwalls for Structural Plate Structures shall be full compensation for all labour, materials, and equipment use required to: supply and place formwork, to supply and install galvanized anchor bolts, to supply reinforcing steel, to protect and clean the reinforcing steel as required, to bend, cut and weld the reinforcing steel, to place the reinforcing steel in the work, to support the reinforcing steel during the

placing, to supply and place concrete, to cure the concrete, and to remove the forms; together with labour, materials, and equipment used to provide such unwatering provisions that may be necessary in order to carry out the work according to these specifications.

It should be clearly understood, that the supply and placement of the reinforcing steel and anchor bolts are included in the basis of payment for Concrete Headwalls for Structural Plate Structures.

451.09 CONCRETE ACCEPTANCE AND REDUCED PAYMENT CRITERIA ON CONCRETE HEADWALLS FOR STRUCTURAL PLATE STRUCTURES

Concrete footings and headwalls, as defined by the contract item and the required specified strength at 28 days, must have an average tested strength at 28 days equal to or greater than that specified for payment at the bid price.

Concrete of a lower strength will have Section 904.11.03 apply for adjustment of the unit price applicable or judgement of the acceptability of the concrete placed for this item.

SECTION 452

REINFORCED CONCRETE SLOTTED WEIR FISH BAFFLES

INDEX

452.01 SCOPE

This specification covers the requirements for the construction of reinforced concrete slotted weir fish baffles. The baffles, incorporating galvanized steel anchor bolts and reinforcing steel, shall be as shown on Form 1222-1 and shall be installed at specified distances along the corrugated steel pipe as indicated in the contract documents and to the satisfaction of the Owner's Representative.

452.02 MATERIALS

452.02.1 Galvanized Anchor Bolts

Type ASTM F3125M Anchor bolts and associated hardware shall be hot dipped galvanized in accordance with CSA G164.

The Contractor shall supply all galvanized anchor bolts and associated hardware required to anchor the concrete baffles to the corrugated steel pipe. Supplied anchor bolts and associated hardware shall be as shown in Form 1222-1.

452.02.2 Concrete

Concrete for use in constructing baffles shall be supplied by the Contractor and shall meet the specification for “Curb, Gutter, Sidewalks, Catch Basins, & Weir Baffles” concrete, in accordance with Section 904.

452.02.3 Reinforcing Steel

Reinforcing steel shall be of the sizes and configuration detailed in Form 1222-1.

Reinforcing steel shall conform to all requirements of Section 905.

452.03 UNWATERING

The Contractor is advised that all work required to install the concrete baffles shall be carried-out in the dry.

All unwatering shall be carried out in accordance with Section 180.

All work shall be in compliance with Division 8 and any additional requirements stipulated in any permits issued by applicable regulatory agencies.

452.04 FORMWORK

Formwork shall be supplied by the Contractor and shall conform to the requirements of Section 907.

452.05 PLACING OF REINFORCING STEEL

Reinforcing steel shall be placed in accordance with the requirements of Section 905.

452.06 PLACING CONCRETE AND GALVANIZED ANCHOR BOLTS

Concrete shall be placed in accordance with the requirements of Section 904.

Anchor bolts shall be installed as detailed on Form 1222-1.

452.07 CURING THE CONCRETE

Concrete shall be cured in conformity with the requirements of Section 904.

452.08 MEASUREMENT FOR PAYMENT

Measurement for payment for “Reinforced Concrete Slotted Weir Fish Baffles” shall be calculated from the dimensions of the concrete baffles as laid out according to the instructions of the Owner’s Representative and such measurements will be computed to obtain the volume in cubic meters, rounded to one decimal place.

No deductions will be made from the volume of concrete for reinforcing or anchorages.

Any concrete required to completely fill the corrugations below the crest of the corrugated steel pipe shall be considered incidental to this item and won’t be included in the total computed volume.

452.09 BASIS OF PAYMENT

Payment at the contract price for “Reinforced Concrete Slotted Weir Fish Baffles” shall be full compensation for all labour, materials, and equipment use: to access the worksite, supply and place formwork, to supply and install galvanized anchor bolts, to supply reinforcing steel, to protect and clean the reinforcing steel as required, to bend, cut and weld the reinforcing steel, to place the reinforcing steel in the work, to support the reinforcing steel during the placing, to supply and place concrete, to cure the concrete, and to remove the forms; together with labour, materials, and equipment use to provide such unwatering provisions that may be necessary in order to carry out the work according to these specifications.

It should be clearly understood, that the supply and placement of the reinforcing steel, anchor bolts and all associated hardware are included in the basis of payment for Reinforced Concrete Slotted Weir Fish Baffles.

452.10 CONCRETE ACCEPTANCE AND REDUCED PAYMENT CRITERIA ON REINFORCED CONCRETE SLOTTED WEIR FISH BAFFLES

Concrete baffles, as defined by the contract item and the required specified strength at 28 days, must have an average tested strength at 28 days equal to or greater than that specified for payment at the bid price.

Concrete of a lower strength will have section 904.11.03 apply for adjustment of the unit price applicable or judgement of the acceptability of the concrete placed for this item.

SECTION 460

CONCRETE PLUGS FOR STORM SEWERS

INDEX

460.01 SCOPE

This specification concerns the supply and placing of cast-in-place concrete plugs to block ends of storm sewers.

460.02 MATERIALS

Plugs shall consist of concrete meeting the specifications for “Mass & Tremie Concrete” as per Section 904.

460.03 CONSTRUCTION

The end of the storm sewer to be sealed with a plug shall be thoroughly cleaned of all dirt and accumulations of debris.

The concrete shall be placed in the end of the sewer to completely block the opening with a thickness of concrete blocking the end not less than 200 millimetres at its narrowest point.

460.04 MEASUREMENT FOR PAYMENT

Measurement for payment for concrete plugs, shall be by the number of concrete plugs installed.

460.05 BASIS OF PAYMENT

Payment at the contract price for each plug shall be compensation in full for all labour, materials and equipment use to clean the existing storm sewer, supply and place a

concrete plug in a storm sewer, any necessary cutting of pipe regardless of size together with such unwatering as may be necessary to carry out the work.

SECTION 461

CONCRETE COLLAR AT CULVERT EXTENSION

INDEX

461.01 SCOPE

This specification deals with the provision of a cast in place concrete collar to secure an extension to an existing culvert.

461.02 MATERIALS

The collar shall consist of concrete meeting the specifications for “Curb, Gutter, Sidewalks, Catch Basins & Weir Baffles Concrete” as per Section 940.

Backfill for use within 300 millimetres of the completed sides and top of the concrete collar shall consist of a select backfill material consisting of a well graded other material having no more than 10% passing the 0.075 millimetre sieve with a maximum particle size not exceeding 75 millimetres.

461.03 CONSTRUCTION

See Form 1220, for details of the required collar.

The Contractor shall provide such unwatering as is necessary in order that the collar be constructed as required. Unwatering shall be carried out as specified in Section 180.

Under the end of the culvert to be extended, the ground shall be excavated in order to facilitate the placing of the concrete collar. The excavation shall extend 150 millimetres back from the end, 150 millimetres in front of the end, and in other material ground shall be to a depth of 300 millimetres below the underside of the culvert. If the pipe is resting on solid rock, then any loose rock shall be removed down to 300 millimetres below the underside, or to solid rock, whichever is less.

Surfaces of the new and existing pipe, to which concrete will be in contact, shall be thoroughly cleaned of all dirt and grease.

Where possible, the extension pipe shall be placed in the end of the culvert so that approximately 100 millimetres of the extension pipe lies within the end of the existing culvert.

Formwork shall be placed to provide at least the minimum dimensions for the collar as shown on Form 1220. Formwork shall be supplied by the Contractor and shall conform to the requirements of Section 907.

Concrete shall be placed and cured in accordance with the requirements of Section 904.

Select Backfill material shall be placed simultaneously on all sides of the collar in layers not exceeding 200 millimetres in thickness. Each layer shall be thoroughly compacted to a compaction of not less than 95% of standard proctor density before a further layer is placed.

Backfilling, with select backfill, shall be continued until the collar has not less than 300 millimetres of select backfill cover.

461.04 MEASUREMENT FOR PAYMENT

Measurement for payment will be based on the number of required concrete collars placed, regardless of the sizes of the various collars

461.05 BASIS FOR PAYMENT

Payment at the contract unit price for Concrete Collar at Culvert Extension shall be compensation in full for all labour, materials and use of equipment to: clean the pipe surfaces which will be in contact with the collar, supply and place formwork, supply and place concrete, remove the formwork, cure the concrete, and to provide such unwatering as is required.

Select backfill material shall be paid for in accordance with Section 206, Section 207 or Section 310, as the case may be, but the additional requirements for the placing and compaction of the select backfill, as stipulated in this specification, shall be considered compensated for as part of the contract price for Concrete Collar at Culvert Extension.

The excavation required in order to place the collar around the culvert shall be paid for in accordance with Section 403.

SECTION 470

CONSTRUCTION AND ADJUSTMENT OF MANHOLES, CATCH BASINS AND DITCH INLETS

INDEX

470.01 SCOPE

This specification covers the requirements for constructing, rebuilding, adjusting and breaking into manholes, catch basins and ditch inlets.

470.02 MATERIALS

470.02.01 Concrete

All concrete shall meet the specification for “Curb, Gutter, Sidewalks, Catch Basins & Weir Baffles” concrete in accordance with Section 904.

470.02.02 Mortar

Mortar shall have the following proportions by weight:

1 PART PORTLAND CEMENT 2 PARTS CLEAN SHARP SAND

Mortar shall be thoroughly mixed in a mechanical mixer of approved type or by hand on an impervious stage with only sufficient water to make the mixture plastic. Only clean water shall be used in mortar.

Mortar shall be applied in a fresh condition before any setting has commenced.

470.02.03 Grout

Grout shall have the following proportions by volume:

1 PART PORTLAND CEMENT 3 PARTS CLEAN SHARP SAND

Grout shall be thoroughly mixed to a consistency such that the grout will just flow evenly; too liquid a mixture will not be acceptable.

Grout shall be used in a fresh condition and any grout which has commenced to set shall not be worked up again but shall be removed from the works.

470.02.04 Bricks

Bricks shall be construction grade bricks.

470.02.05 Reinforcing Steel

Reinforcing steel shall conform to the requirements of Section 905.

470.02.06 Manhole and Catch Basin Steps

Manhole and catch basin steps shall be ladder rungs of the approximate dimensions as shown on the drawings for catch basins.

The materials of the ladder rungs shall be galvanized steel or an aluminum alloy.

Galvanized steel ladder rungs shall conform to the requirements of CSA Standard G30.18 and shall be hot dip galvanized according to CSA Standard G164 to provide a zinc coating of not less than 0.6 kilogram per square metre. The carbon content of the steel shall not exceed 0.25%.

Aluminum alloy rungs shall conform to the requirements of CSA Standard HA5.

470.02.07 Weep Hole Pipes

Weep hole pipes shall be of the diameters as shown on the drawings and shall consist of galvanized steel, aluminum, clay or plastic pipe.

470.02.08 Precast Reinforced Concrete Manhole, Catch Basin and Ditch Inlet Components and Precast Concrete Adjustment Units

Precast units shall conform to design approved by the Engineer of Record. Materials used in the units shall conform to the requirements of this specification.

470.02.09 Pipe Seals

Pipe seals used in connecting pipes to manholes, catch basins and ditch inlets shall be of types approved by the Owner’s Representative.

470.02.10 Manhole and Catch Basin Frames, Grates, Covers and Lift Rings

All frames, grates and covers shall conform to the size and configuration indicated on the drawings for the particular type specified on the contract unit price table.

Castings shall conform to the requirements of Class No. 30C as specified in the most recent version of ASTM A48.

Castings shall be sound, free from pouring faults, sponginess, cracks, blow holes and other defects. Bearing surfaces shall be machined if necessary so that the grates and covers sit firmly on the frames without rocking.

Castings shall be thoroughly cleaned and coated with a commercial quality asphaltic paint of a type suitable as a protective coating for iron castings.

Lift rings shall be of a type approved by the Owner's Representative.

470.02.11 Ditch Inlet Grating and Hardware

Ditch inlet grating, I-beam, anchor bolts, nuts and washers shall be as shown in the appropriate drawing for the required size of ditch inlet manhole, and Form 1260.

The Contractor shall construct each grating so that it is of the required dimensions to fit the ditch inlet for which it is required. The inlet grates shall be composed of materials conforming to Metal Grating Institute #RF-37-5 or approved equal. The end bearing bar shall be welded to the angle bar along both legs with a 5 millimetre fillet weld.

When fabrication of the grating is complete, the grating and the I-beam shall be shop painted with asphalt having a softening point not lower than 70 degrees Celsius. Alternatively, a tar base black paint shall be used.

Anchor bolts, together with accompanying nuts and washers shall be galvanized.

470.03 OPTIONS

The Contractor may choose between poured-in-place or precast units. Should the Contractor wish to use precast units, then the Contractor shall submit plans and specifications to the Owner's Representative for a review of their suitability for use in the type of structure required. Only precast units which conform to designs approved by the Engineer of Record shall be used.

In the event that a round catch basin is proposed as a substitution for a square/rectangular catch basin, the Contractor is advised that compensation will be based on the original bid price for the square/rectangular catch basin. Any necessary adjustments, including diameter or wall thickness increases or modifications to the configuration, required to ensure that the round catch basin meets the project's functional and design requirements, will be considered incidental to the original item. No additional payment will be made for these adjustments. The Contractor shall be responsible for ensuring that the round catch basin, as substituted, meets all project specifications and standards without impacting the project's schedule or cost.

470.04 CONSTRUCTION OF MANHOLES, CATCH BASINS AND DITCH INLETS

Manholes, catch basins or ditch inlets of the type specified shall be excavated for and constructed to conform to the requirements of the contract drawings, or the approved

precast structure, and shall be located at the points and elevations as staked by the Owner's Representative.

470.04.01 Excavation

The Contractor shall carry out and be paid for excavations in accordance with the requirements of Section 404.

470.04.02 Poured in Place Construction

The Contractor shall form and pour the specified unit plumb and true to alignment and grade as set by the Owner's Representative.

Formwork shall be supplied by the Contractor and shall conform to the requirements of Section 907.

Concrete shall be placed in accordance with the requirements of Section 904.

The Contractor shall incorporate all built-in hardware as is shown on the appropriate drawings for the particular type of structure being built.

Once forms have been stripped the Contractor shall remove all inside wall protuberances.

Concrete shall be cured in conformity with the requirements of Section 904.

470.04.03 Precast Construction

The precast unit shall be placed plumb and true to alignment and grade as set by the Owner's Representative.

Precast bases shall be set to the grade as staked, shall be level, and shall have uniform overall contact with the underlying ground.

Any adjustment of the unit for plumb, alignment, and grade shall be carried out by lifting the unit free of the excavation, levelling the base, and replacing the unit to proper alignment and grade. Should the adjustment involve placing material under the base, then the placed materials shall be compacted to at least 95% of the Standard Proctor Density.

470.04.04 Pipe Connections

When constructing cast-in place units, pipes may be built-in, or holes may be kept in the walls at the required grades and locations so that the pipes can be placed later.

For precast units, the Contractor shall cut holes into the side of the structure at required locations.

Pipes shall not extend out from interior walls more than 0.3 metres unless specifically directed by the Owner's Representative.

These pipes that are placed in a prepared or cut hole in the wall shall be securely sealed into place using grout or pipe seals. Grout shall be well and truly worked into all holes and spaces between the pipe and wall so as to completely fill the spaces and form a strong watertight bond. Seals shall be installed according to the manufacturer's directions.

470.04.05 Installation of Manhole and Catch Basin Frames, Grates and Covers

The manholes and catch basins shall be constructed or installed so that the surface on which the mortar bed is to be placed is at least 20 millimetres but not more than 150 millimetres below the bottom of the frame and grate or frame and cover assembly.

Before application of mortar to the manhole or catch basin, the Contractor shall thoroughly clean the surface to which mortar is to be applied.

Frames for grates or covers on manholes and catch basins shall be set in a full mortar bed.

Bricks or precast concrete adjustment units may be used to set the frame and grate or frame and cover at the required position and elevation. Bricks shall be laid in double width using a Flemish bond. The inside and outside surfaces of the brick shall be plastered with a 10 millimetre thick mortar coat.

The frames and grates or frames and covers shall be set to the lines and grades as staked by the Owner's Representative.

470.04.06 Installation of Grating for Ditch Inlet

Gratings for ditch inlets shall be installed and securely fastened down with a washer and nut as indicated in the contract drawings.

470.04.07 Backfilling

Backfilling shall be carried out using select bedding material which shall be placed and paid for according to the requirements of Section 410.

The placing of select bedding materials shall not commence until the structure has cured to the specified design strength at 28 days. Should the Contractor wish to commence the placing of material before 28 days after pouring, then the Contractor will be required to prove that the 28 day specified design strength has been obtained before permission to commence backfilling will be granted.

470.05 ADJUSTMENT AND REBUILDING OF MANHOLES, CATCH BASINS AND DITCH INLETS

470.05.01 Scope

The work to be carried out shall include change of elevation of either a manhole, catch basin or ditch inlet, regardless of type or size.

Adjustment of manholes, catch basins or ditch inlets will apply where the top of the structure is to be raised or lowered 1.0 metre or less.

Rebuilding of manholes, catch basins or ditch inlets will apply to where the top of the structure is to be lowered or is to be raised more than 1.0 metre.

470.05.02 Excavation

Where bituminous pavement must be removed to adjust or rebuild a structure the pavement shall be cut and excavated.

When concrete curb and gutter or concrete sidewalk must be removed to adjust or rebuild a structure, the curb and gutter or sidewalk shall be cut and excavated. This work of cutting and excavating shall be carried out and paid for in accordance with Section 511 and Section 521.

The Contractor shall excavate such granular base course materials together with catch basin backfill materials that it is necessary to excavate in order to carry out the adjustment or rebuilding. These materials shall be piled in a manner that will not endanger the work or obstruct traffic or pedestrians, but will permit the materials future use as backfill for the completed structure.

Prior to adjustment or rebuilding, the existing frame and grate or cover shall be carefully removed and salvaged in order that it may be re-used.

470.05.03 General Adjustment and Rebuilding Work

All existing mortar and brickwork shall be removed from the top of the existing structures prior to adjustment or rebuilding with precast adjustment units.

Where the work involves adjusting or rebuilding a ditch inlet, then the Contractor shall supply and place such new anchor bolts, nuts and washers as are required to carry out the work.

Where the work involves poured in place concrete or placing pre-cast units, then the work shall conform to the requirements of Section 470.04.02 or Section 470.04.03 as the case may be.

Once a manhole, catch basin, or ditch inlet has been adjusted or rebuilt the salvaged or a new frame and grate or frame and cover, as required, shall be set to the correct elevation on the adjusted or rebuilt structure. This shall be done in accordance with the requirements of Section 470.04.05 or Section 470.04.06 as the case may be.

All construction debris resulting from adjustment or rebuilding of the structures shall be kept separate from excavated backfill materials.

470.05.03.01 Adjustment

When manhole or catch basin covers are to be raised only to accommodate re-surfacing of the adjacent pavement, the Contractor may use manhole cover lift rings to raise the cover a sufficient height to accommodate the thickness of re-surfacing material.

Bricks may be used to raise structures up to 0.3 metres. Precast concrete adjustment units may be used to raise structures up to 1.0 metre. Where bricks are used, they shall be plastered inside and outside with a 10 millimetre thick mortar coat.

Where structures have already been extended using bricks and they are further adjusted upward with bricks, the total height of adjustment shall not exceed 0.3 metres.

Where structures have already been extended using concrete adjustment units and they require further upward adjustment, the total height of adjustment shall not exceed 1.0 metre.

Where the top of units are to be raised, including structures with a domed upper section, concrete adjustment units, manhole cover lift rings or bricks shall be removed or added as required to adjust the structure to the proper elevation.

470.05.03.02 Rebuilding

To lower the top of cast-in-place structures with a domed upper section the concrete in the structure shall be removed for the entire depth of the doming plus as much of the straight wall section as is necessary. The upper section of the structure shall then be rebuilt with a standard dome.

To lower the top of straight walled cast-in-place structures, the upper section of concrete shall be removed.

To raise the top of cast-in-place structures with a domed upper section, the concrete in the structure shall be removed for the entire depth of the doming. The upper section, including straight walls and dome shall then be rebuilt.

To raise the top of straight walled cast-in-place structures, the existing walls shall be extended upward in concrete.

Where cast-in-place units are to be raised with cast-in-place concrete, the top surface of all existing walls shall be roughened before the walls are extended upwards.

Where the top of a precast structure is to be lowered or raised, the cone section shall be removed and riser sections of suitable height shall be removed, substituted for, or added to the existing riser sections. The cone section shall then be replaced.

470.05.04 Backfilling

Backfilling shall be carried out using excavated granular base course materials and excavated catch basin backfill materials. The backfill shall be placed and compacted in accordance with the requirements for placing and compacting bedding material as given in Section 410.

Backfilling shall be placed up to subgrade elevation.

Where cast-in-place construction has been used to carry out the adjustment or rebuilding, then the placing of backfilling material shall not commence until the structure has cured to the specified design strength at 28 days. Should the Contractor wish to commence the placing of material before 28 days after pouring, then the Contractor will be required to prove that the 28 day specified design strength has been obtained before permission to commence backfilling will be granted.

470.06 BREAKING INTO MANHOLES, CATCH BASINS AND DITCH INLETS

470.06.01 Scope

This specification concerns the connection of a storm sewer or sub-drain to a catch basin, manhole or ditch inlet, which was not built as part of this contract.

470.06.02 Excavation

Excavation shall be carried out and paid for as part of the excavation for the storm sewer or sub-drain in accordance with Section 404.

470.06.03 Construction

The Contractor shall cut a hole into the side of the structure at the location and grade as staked by the Owner's Representative. The pipe shall be securely and neatly grouted in place at the required grade. The grout shall be well and truly worked into all holes and spaces between the pipe and wall so as to completely fill the spaces and form a strong watertight bond.

470.06.04 Backfilling

The grout shall be allowed to cure for at least 7 days before any backfill may be placed next to the connection.

Backfilling shall consist of the placing of select bedding and backfill for the pipe. Backfill shall be placed, compacted and paid for in accordance with Section 410 and Section 404a respectively.

470.07 CLEAN-OUT

During the progress of the work and until the completion and final acceptance, manholes, catch basins and ditch inlets shall be kept clean and free of all foreign material.
The Contractor shall dispose of debris and surplus materials at their own expense.

470.08 MEASUREMENT FOR PAYMENT

Dependent on the items specified, measurement will be made by one of the following methods:

470.08.01 Measurement for Payment for Construction of Manholes, Catch Basins and Ditch Inlets

Measurements will be based on the number of each type of required manhole, catch basin, or ditch inlet placed at the required locations and grades.

470.08.02 Measurement for Payment for Adjustment and Rebuilding of Manholes, Catch Basins and Ditch Inlets

The alteration to each structure will be measured in metres, rounded to one decimal place. Measurement for payment will be made by taking the difference in elevation of the top of grate or cover at the centre prior to and after the adjustment with the following exceptions:

(a) When rebuilding domed structures, the actual measured adjustment will be increased by the height of the dome portion.

(b) Where the measured adjustment is less than 0.3 metres, the measurement for payment will be taken to be 0.3 metres.

470.08.03 Measurement for Payment for Supply of Frames, Grates, Covers and Gratings

Measurement for payment for the supply of frame and grate, frame and cover or grating will be based on the number of each type of frame and cover, frame and grate or grating supplied for incorporation into the adjustment or rebuilding of manholes, catch basins and ditch inlets.

470.08.04 Measurement for Payment for Breaking into Manholes, Catch Basins and Ditch Inlets

Measurement will be based on the number of connections made at the required locations of the grades.

470.09 BASIS OF PAYMENT

470.09.01 Basis of Payment for the Construction of Manholes, Catch Basins and Ditch Inlets

Payment of the contract price for each of the required type of manhole, catch basin, or ditch inlet placed shall be full compensation for all labour, materials and equipment-use to: supply all materials (including required grating, frame and cover, frame and grate, or frames and grates, as the case may be) required to construct the structure as shown on the drawings, construct and cure a cast-in-place unit or install a precast unit, carry out such required preparation and compaction of a bed as may be necessary for the base of a precast unit, install such reinforcement steel, anchor bolts, I-beams, ladder rungs, pipe for weeping holes and such other required hardware, install pipes in the walls, install the required type of grating, frame and cover, frame and grate or frames and grates, place anchor bolts or full mortar bed as appropriate, place and parge bricks or place precast concrete adjustment units as required, provide any required unwatering and shearing and

shoring, and to carry out any necessary work to complete the structure in accordance with the contract requirements.

Excavation required prior to manhole, catch basin, or ditch inlet construction shall be paid for in accordance with Section 404.

Backfilling of new manholes, catch basins, or ditch inlets shall be paid for in accordance with Section 410.

470.09.02 Basis of Payment for the Adjustment and Rebuilding of Manholes, Catch Basins and Ditch Inlets

Payment at the contract price per metre for adjustment and rebuilding of manholes, catch basins and ditch inlets shall be full compensation for all labour, materials and equipment-use to supply all materials (except frame and grate, frame and cover or grating) required to carry out the alteration regardless of size or type, cut, remove and dispose of existing asphalt, carry out all necessary excavation after pavement, sidewalk and curb and gutter have been removed, remove and dispose of concrete and bricks in the structure, salvage the grating, frame and cover, frame and covers or frames and grates, place and cure cast-in-place concrete, place precast concrete adjustment units, place and parge bricks, place such additional ladder rungs as may be required, place any required manhole rings, place anchor bolts or full mortar bed as appropriate, re-install salvaged frame and cover, frame and grate, frames and grates or grating or install new frame and cover as required, provide any required unwatering and shearing and shoring, place and compact backfill, and supply, place and compact Granular “A”, Granular “B” and asphalt including liquid and blending sand, together with all other items of work necessary for the satisfactory completion of the work, except for the cutting and removal, curb and gutter and sidewalk which will be paid for under separate contract items.

470.09.03 Basis of Payment for Supply of Frames and Covers, Frames and Grates and Gratings

Payment at the contract price for each type and set of frame and grate, frame and cover and grating supplied shall be full compensation for all labour, materials and equipment-use to supply and deliver the required type of frame and grate, frame and cover, or grating to the location where the hardware is to be incorporated into the manhole, catch basin, or ditch inlet adjustment or rebuilding.

470.09.04 Basis of Payment for Breaking into Manholes, Catch Basins and Ditch Inlets

Payment at the contract price for each connection made shall be full compensation for all labour, materials and equipment-use to provide openings in existing structures and grout in the pipe to be connected, regardless of the size of the pipe.

Excavation and backfilling shall be paid for in accordance with Section and bedding shall be paid for in accordance with Section 410.

SECTION 475

ADJUSTMENT OF WATER VALVE BOX

INDEX

475.01 SCOPE

This specification covers the requirements for the work of adjusting the elevation of water valve boxes to match proposed grade changes. This work is typically required prior to paving, or pavement recapping operations, so that the elevation of the valve box cover will match the elevation of the proposed recapped finish grade.

475.02 DESCRIPTION

The Contractor shall carry out such excavation as is necessary so that the valve box is exposed sufficiently so that it may be adjusted to the required grade.

Where the valve box is set in pavement, the Contractor shall cut the existing pavement to a square or rectangular shape around the valve box. Each cut line shall be at least 200 millimetres from the edge of the valve box. Cuts shall be finished straight with vertical edges.

During excavation operations, all contaminated select granulars, dirt and debris shall be removed and disposed of.

The valve box shall be adjusted so that the cover is at the required finished grade or as directed by the Owner's Representative. Should the valve box, or any other parts, become damaged during the operations, then the Contractor shall replace the damaged parts with new parts.

The bottom of the excavation shall be compacted, using hand operated compaction equipment if necessary.

The hole shall be backfilled with Other Material, new granular "B" material, and new granular "A" material, in layers as appropriate. Each layer shall be compacted before the next layer is placed. Layers shall not be thicker than 150 millimetres.

The bottom of the excavation, and each layer of select granulars shall be compacted to 100% of the maximum Standard Proctor Density (ASTM D698).

In pavement recapping operations, the top of the compacted Granular "A" shall be brought level with the bottom of the existing pavement, then the area around the valve box shall be patched with hot mix asphaltic pavement to the full depth of the existing pavement. The asphaltic pavement shall meet the requirements for either asphaltic base, or asphaltic surface course as stipulated in Section 330, 332 and 333, as appropriate.

Immediately prior to patching, the vertical faces of the existing pavement shall be treated with tack coat.

The hot mix asphaltic concrete shall be placed in layers not thicker than 50 millimetres, and compacted, before the next layer is placed. Compaction of the hot mix asphaltic pavement shall conform to the requirements stipulated in Section 330. 332 and 333, as appropriate.

475.03 MEASUREMENT FOR PAYMENT

Measurement for payment for Adjustment of Water Valve Box shall be on the basis of the number of water valve boxes adjusted to the required grades.

475.04 BASIS OF PAYMENT

Payment at the contract price for Adjustment of Water Valve Box shall be compensation in full for all materials, labour, and use of equipment required to:

Supply all materials, including: Selected Granular Base Course Class "A" ,select granular base course Class "B", asphalt cement, and asphaltic concrete, to cut existing pavement, to excavate existing pavement and granular materials from around the valve box, to adjust the valve box to the required grade, to place and compact Other Material, granular "B", and granular "A", to treat the cut edge of existing pavement with asphalt cement, to place and compact hot asphaltic concrete around the adjusted valve box, tack coat between layers of asphaltic concrete and to dispose of all waste materials.

The Contractor shall allow for in their unit price all costs associated with any hand work required to carry-out the work as described in this specification.

The basis of payment for Adjustment of Water Valve Box also includes compensation in full for all materials, labour, and use of equipment required to supply and replace any valve boxes and parts damaged by the Contractor during the adjustment of water valve box operation.

SECTION 480

INSTALLATION OF CONCRETE CURB AND GUTTER

INDEX

480.01 SCOPE

This specification covers the requirements for the construction of various types of concrete curb and gutter on a prepared bed of granular base course. Curb and gutter of the type as stipulated in the Unit Price Table will include the provision of drop curbs, paraplegic ramps, and tapered ends together with the incorporation of catch basins and manhole gratings as staked by the Owner's Representative.

480.02 MATERIALS

Concrete shall meet the all requirements for "Curb, Gutter, Sidewalks, Catch Basins & Weir Baffles" concrete, in accordance with Section 904.

Material for forming isolation joints shall be 12 millimetre thick bituminous fibre material.

Material for forming control joints shall be 12 millimetre thick bituminous fibre material for the set-in-place type, or a bituminous filler material for the groove or saw-cut type.

All materials, including formwork, shall be supplied by the Contractor.

480.03 PREPARATION WORK

Should excavation be required prior to placing the bed for the curb and gutter, then such work shall be carried out and paid for in accordance with Section 206 or Section 403.

When fill is required prior to placing the bed for the curb and gutter, then this work shall be carried out in accordance with Section 204.

After the site has been graded, as described above, a bed shall be laid composed of granular base course Class "B", or Class "A" to the satisfaction of the Owner's Representative. The bed shall be laid to the lines and grades as staked by the Owner's Representative.

The compacted depth of the bed should not be less than 100 millimetres. The bed shall be compacted to not less than 95% of the Standard Proctor Density (ASTM D698).

480.04 FORMWORK

Formwork shall conform to the requirements of Section 907.

Forms shall be set to provide curb and gutter of the required type, to the grades and lines as staked by the Owner's Representative.

Curb and gutter shall be of Types "C", "D", "G", or "H" as shown in the drawing in Section 1275 "or of other types shown on the project drawings.

At those places where a drop curb or a tapered end is required, the forms shall be set so as to obtain a finished concrete surface as shown in the drawings in Section 1276, Section 1277 or Section 1278, as the case may be.

480.05 PLACING THE CONCRETE

Concrete shall be placed in accordance with the requirements of Section 904.

The curb and gutter shall be laid so as to incorporate catch basin, and manhole frames and grates which lie on the line of the curb and gutter.

The concrete on the upper surfaces shall be floated to a smooth uniform finish of the required cross section, free of open textured aggregate and local projections. No deviation of greater than 3 millimetres in a 3 metre straight edge shall be tolerated.

Care shall be taken to avoid over finishing or working more mortar to the surface than is actually required.

Back edges shall be rounded by use of a 6 millimetre radius edging tool.

Neat cement shall not be used as a drier to facilitate finishing.

Any honeycombed areas occurring along the formed surfaces shall be filled with mortar composed of one part Portland Cement and two parts sand.

The provisions of this specification may be modified by the Owner's Representative at the Contractor's request to suit construction by extrusion methods if the Contractor can demonstrate to the Owner's Representative's satisfaction that by such methods a quality will be achieved at least equal to that produced by standard methods. Notwithstanding approval of such modifications, the Owner's Representative may, at any time, require the Contractor to revert to standard methods if, in their opinion, the required results are not being obtained.

480.06 JOINTS

When concrete curb and gutter is constructed immediately adjacent to another structure such as concrete pavement, concrete sidewalk, catch basin frame or gutter outlets, then the Contractor shall construct a full depth isolation joint between the structure and the curb and gutter. Isolation joints shall also be constructed at points of curvature for short radius curves.

Isolation joints shall consist of a 12 millimetre thick bituminous fibre panel cut to such size so as to provide a full depth joint extending for the full width. The bituminous fibre panels shall be set vertical in the forms before the concrete is poured.

Panels shall be pre-cut to the shape of the joint so as to provide a 6 millimetre recess on the exposed surfaces. The Contractor has the option of either providing a 6 millimetre deep, 12 millimetre wide cap strip, to be removed after the concrete has hardened and not edging the joints, or carefully removing all concrete immediately above the filler material to form a 6 millimetre deep, 12 millimetre wide recess then finishing both edges of each joint to 6 millimetre radius with a suitable short edging tool.

When concrete curb and gutter is constructed adjacent to asphalt pavement, control joints shall be spaced at intervals not exceeding 6 metres. However, when concrete curb and gutter is constructed adjacent to concrete pavement, control joints shall coincide with joints in the pavement. Control joints may be formed using a 12 millimetre thick bituminous fibre panel cut to such size so as to provide a joint extending not less than one quarter the depth of the curb and gutter for the full width. The bituminous fibre panel control joints shall be set vertical in the forms before the concrete is poured.

Panels shall be pre-cut to the shape of the joint so as to provide a 6 millimetre recess on the exposed surfaces. The methods of obtaining these 6 millimetre recesses shall be as previously stipulated for isolation joints.

Alternatively control joints may be formed by the use of a "guillotine" knife in fresh concrete or saw cutting the hardened concrete within a sufficient time of placing to prevent uncontrolled cracking. Groove or saw-cut control joints shall be of thickness between 3 and 5 millimetres, depth not less than one quarter the depth of the curb and gutter and width the full width of the curb and gutter. When the concrete is dry, the control joints shall be completely filled with a bituminous filler material. Immediately prior to the filling, the joint shall be thoroughly cleansed of all dust, and particles of foreign matter.

Construction joints shall be built at convenient stopping places in the placement of the concrete. They may be butt type or isolation joints and they shall be the full depth and width of the curb and gutter. They shall be built at the end of each day's construction or when there is a delay in the supply of concrete and cold joints might develop.

480.07 CURING THE CONCRETE

Concrete shall be cured in accordance with the requirements of Section 904. Consideration will be given to the use of white pigmented curing compound applied according to the manufacturer’s recommendations.

480.08 TRIMMING

Trimming of adjacent materials shall be carried out behind the curb and gutter which is to remain in isolation without abutting a sidewalk.

After the removal of the forms and after the initial curing of the concrete, the Contractor shall grade and tamp adjacent granular materials against the rear of the curb and gutter to form shoulders to the sidewalk. These shoulders shall be made trim to sightly proportions.

480.09 PROTECTION OF CURB AND GUTTER FROM TRAFFIC AND PEDESTRIANS

The Contractor shall by barricades, security, or other means, protect all curb and gutter from harm by traffic or pedestrians, until the Owner's Representative authorizes the curb and gutter open to those who wish to cross over the curb and gutter.

The Contractor shall at all times prior to the opening to traffic provide suitable bridging or other means of access to adjacent properties.

480.10 MEASUREMENT FOR PAYMENT

Measurement for payment for the installation of curb and gutter of a particular type of curb and gutter shall be the length in metres, rounded to one decimal place, as measured along the exposed face of the curb of the type in question. Such measurements will include the space occupied by gutter outlets and frames and grates.

Curb and gutter installed outside of the lines and grades as staked by the Owner's Representative will not be measured for payment.

480.11 BASIS OF PAYMENT

Payment at the contract price for curb and gutter for the type in question shall be full compensation for labour, materials and equipment-use to supply and place formwork and concrete, to provide tapered ends and drop curbs as required, to incorporate any catch basin frames into the curb and gutter, to construct joints, to provide and place joint filler, to cure the concrete, to protect the curb and gutter from traffic, to remove the forms, to shoulder the back of the curb with adjacent material, and to tamp the shoulders behind the curb.

Granular base course for providing the bed shall be paid for in accordance with the contract unit price for Granular "B" or Granular "A", as appropriate, but any additional labour required to place this bed as specified shall be considered compensated for in the contract price for curb and gutter.

480.12 CONCRETE ACCEPTANCE AND REDUCED PAYMENT CRITERIA ON CONCRETE LOCATED IN CURBS AND GUTTER

Concrete on a project for a specified Type of curb and gutter, and also as defined by its specified strength at 28 days, must have an average tested strength at 28 days equal to or greater than that specified for payment at the bid price.

Concrete for a certain Type of Curb and Gutter having an average strength of less than that specified will be accepted into the job at a reduced payment, provided the difference between specified strength and tested strength is no greater than 5 MPa. If the average of tests in a particular predefined portion of curb and gutter is less than that specified by more than 5 MPa then that concrete shall be rejected.

When concrete is rejected, those provisions outlined in the most recent version of CSA-A23.I shall be followed to determine whether or not the concrete may remain in the work. Such work will be done at the Contractors cost. Notwithstanding the above, should the concrete remain in the work it will be subject to a reduction, as outlined below, for having a strength less than that specified.

Concrete of a specific Type of Curb and Gutter and otherwise acceptable but having an average strength deficiency as tested of less than 5 MPa compared with that specified, will be accepted but the bid price for all concrete in the predefined portion will be reduced according to the following procedure:

For concrete work where the Unit Price Table states the unit to be linear metres the adjusted price shall be calculated as follows:

$(Adjusted Concrete Price) = (Tested Strength/Specified Strength) x $(Bid Concrete Unit Price)

Division of the curb and gutter into predefined portions will be done by the Owner’s Representative as the concrete placement is carried out. A predefined portion shall generally be established as that concrete placed within one operation.

There will be no bonus payment under the contract when the average strength is in excess of the specified strength.

SECTION 485

INSTALLATION OF ASPHALT CURB

INDEX

485.01 SCOPE

This specification covers the requirements for the installation of asphalt curb on top of existing pavement. See Form 1274.

485.02 MATERIALS

Material for use in constructing the asphalt curb shall comprise hot asphaltic mix conforming to the requirements for surface course, as set forth in Section 330, 332 and 333, as appropriate.

Tack coat shall be used to prepare the paved shoulder for the curb and to be used in finishing the asphalt curb. Tack coat shall conform to the requirements stipulated in Section 320.

485.03 EQUIPMENT

The asphalt paver shall be supplied with a template capable of being attached to the paver so that the required cross section is provided or as accepted by the Owner's Representative

The hand operated roller for compacting shall weigh not less than 135 kilograms.

The equipment shall meet the approval of the Owner's Representative, before it may be used in the work.

485.04 CONSTRUCTION

If there is no existing paved shoulder on which to construct the asphalt curb, then paving operations to provide a paved shoulder shall be completed, before installing the asphalt curb.

The surface of the existing asphalt on which the asphalt curb is to be placed shall be cleaned, and all dirt, and all loose and broken materials shall be removed.

The existing asphalt shall be treated with tack coat prior to installation of the asphalt curb. The tack coat shall extend for the full length of the proposed curb, and shall be of a width extending 150 millimetres, from the proposed back of the curb, towards the proposed front.

The tack coat shall be allowed to dry until it reaches the required state of tackiness before the curb is placed.

Asphaltic mix shall not be placed unless the surface is dry and the air temperature is at least 7 degrees Celsius.

The asphalt curb shall be constructed using the approved asphalt paver and template or as accepted by the Owner's Representative. The asphaltic mix shall be placed to the dimensions after compaction, as shown on Form 1274. The asphaltic curb shall be constructed to the lines required by the Owner's Representative.

The asphalt curb shall be compacted using the hand operated roller. However, in areas that cannot be reached by the roller, the compaction shall be carried out with hot hand tampers.

The surface of the asphalt curb after compaction shall be of uniform texture, smooth and true to the required lines and cross section. The finished surface shall be free from depressions exceeding 3 millimetres as measured from the bottom edge of a 3 metre straight edge placed anywhere along the surface of the curb and parallel to the edge.

485.05 MEASUREMENT FOR PAYMENT

Measurement for payment for the installation of asphalt curb, shall be the length in metres, rounded to one decimal place, as measured along the roadside face of the curb.

Curb installed outside of the lines required by the Owner's Representative will not be measured for payment.

485.06 BASIS OF PAYMENT

Payment at the contact price for installation of asphalt, curb shall be compensation in full for all materials, labour, and use of equipment: to supply all materials including surface course asphaltic mix and tack coat, to clean the surface on which the curb is to be placed, to apply tack coat to the underlying shoulder, to construct the curb to the required lines and section, to compact the curb.

The Contractor shall allow for in their price all costs associated with any hand work required to carry-out the work as described in this specification.

Should pavement be required to widen existing pavement to construct a base for the curb, then such pavement shall be compensated for separately, in accordance with the provisions of Section 330, 332 and 333, as appropriate.

SECTION 486

INSTALLATION OF ASPHALT GUTTER

INDEX

486.01 SCOPE

This specification covers the requirements for the installation of asphalt gutter. See Form 1273.

486.02 MATERIALS

Material for use in constructing the asphalt gutter shall be comprised of hot asphaltic mix conforming to the requirements for surface course, as set forth in Section 330, 332 and 333, as appropriate.

Where required, tack coat shall be used to prepare the existing underlying asphalt or adjoining asphalt. The asphalt gutter shall be finished with tack coat. Tack coat shall conform to the requirements stipulated in Section 320.

486.03 EQUIPMENT

The hand operated roller for compacting shall weigh not less than 135 kilograms.

The asphalt paver shall be supplied with a template capable of being attached to the paver so that the required cross section is provided or as required by the Owner's Representative.

486.04 CONSTRUCTION

The gutter shall have the section as shown in Form 1273, or as required by the Owner's Representative. The gutter shall be constructed to the lines required by the Owner's Representative.

Should Selected Granular Base Course Class "A", not be present where it is required to place asphalt gutter, then Excavation for Foundations operations shall be carried out to facilitate the placing of Class "A". The Class "A" shall be placed to the required lines and contoured to the required section. Hand work may be required to obtain the required section and smooth lines.

The Class "A" shall be compacted using the hand operated roller. However, in areas that cannot be reached by the roller, the compaction shall be carried out with hand tampers.

Asphalt shall not be placed until the Class "A" has been contoured to the required smooth lines and section, and compacted to at least 95% of Standard Proctor Density ASTM-D698.

The asphaltic mix shall be placed to the required smooth lines, thickness and width with the use of a mold to attain the required gutter shape. The asphalt gutter shall be constructed using the approved asphalt paver and template. The asphaltic mix shall be placed to the dimensions after compaction, as shown on Form 1273, or as required by the Owner's Representative.

The asphaltic gutter shall be constructed to the lines required by the Owner's Representative.

Asphaltic mix shall not be placed unless the surface is dry and the air temperature is at least 7 degrees Celsius.

The asphalt gutter shall be compacted using the hand operated roller. However, in areas that cannot be reached by the roller, the compaction shall be carried out with hot hand tampers.

The surface of the asphalt gutter after compaction shall be of uniform texture, smooth and true to the required lines and section. The finished surface shall be free from depressions exceeding 3 millimetres as measured from the bottom edge of a 3 metre straight edge placed anywhere along the surface of the gutter parallel to the edge. After the compacted asphalt gutter has cooled to ambient temperature, the Contractor shall spray the exposed

surface with tack coat. The tack coat shall be applied before the surface becomes contaminated by any material which would prevent bond.

486.05 MEASUREMENT FOR PAYMENT

Measurement for payment will be by the length and width as constructed to the satisfaction of the Owner's Representative, and such measurements will be computed into square metres, rounded to one decimal place.

486.06 BASIS OF PAYMENT

Payment at the contact price for installation of asphalt gutter shall be compensation in full for all labour, materials and use of equipment: to carry out such hand work as is required to place and contour the underlying Class "A" to the required smooth lines and section, to compact the Class "A", to construct the gutter to the required lines and section, to compact the gutter, to supply tack coat for finishing, and to finish the curb with tack coat.

The Contractor shall allow for in their price all costs associated with any hand work required to carry-out the work as described in this specification.

However, payment for the actual supply of the surface course hot mix, and the Selected Granular Base Course Granular "A", shall be in accordance with the provisions of Section 330, 332, 333, as appropriate, as well as Section 315.