

## SECTION 411

### SELECT BACKFILL FOR LONG SPAN STRUCTURAL PLATE STRUCTURES

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#### **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):  $Cu \geq 4$
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 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 <sup>-</sup> )	< 100 ppm	T291	D512
Sulphates (SO <sub>4</sub> <sup>2-</sup> )	< 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.