

RETAINED SOIL SYSTEM, TRUE ABUTMENT - Item No.
RETAINED SOIL SYSTEM, FALSE ABUTMENT - Item No.
RETAINED SOIL SYSTEM, WALL/SLOPE, HIGH PERFORMANCE - Item No.
RETAINED SOIL SYSTEM, WALL/SLOPE, MEDIUM PERFORMANCE - Item No.
RETAINED SOIL SYSTEM, WALL/SLOPE, LOW PERFORMANCE - Item No.
**RETAINED SOIL SYSTEM WITH FINISHING CAP, WALL/SLOPE, HIGH PERFORMANCE -
Item No.**
**RETAINED SOIL SYSTEM WITH FINISHING CAP, WALL/SLOPE, MEDIUM PERFORMANCE -
Item No.**
RETAINED SOIL SYSTEM, ROADBASE EMBANKMENT - Item No.
BACKFILL FOR RETAINED SOIL SYSTEM, ULTRA LIGHTWEIGHT - Item No.
BACKFILL FOR RETAINED SOIL SYSTEM, LIGHTWEIGHT - Item No.
BACKFILL FOR RETAINED SOIL SYSTEM, HIGH PERFORMANCE - Item No.
BACKFILL FOR RETAINED SOIL SYSTEM, MEDIUM PERFORMANCE - Item No.
BACKFILL FOR RETAINED SOIL SYSTEM, LOW PERFORMANCE - Item No.

Special Provision No. 599S22

March 2018

REQUIREMENTS FOR RETAINED SOIL SYSTEMS (RSS)

1.0 SCOPE

This Special Provision covers the requirements for the design and construction of retained soil systems (RSS) walls and steep slopes.

Additional requirements for RSS precast concrete facing elements shall be as specified in the Contract Documents.

2.0 REFERENCES

This Special Provision refers to the following standards, specifications or publications:

Ontario Provincial Standard Specifications, Construction

OPSS 501 Compacting

Ontario Ministry of Transportation Publications

MTO Designated Sources of Materials (DSM)
Qualification Criteria for RSS

CSA Standards

S6-14 Canadian Highway Bridge Design Code (CHBDC)

3.0 DEFINITIONS

For the purposes of this Special Provision the following definitions apply:

Alignment Elements means components specified by the manufacturer that are constructed on the foundation for RSS to facilitate placing of the facing elements to the correct lines and grades, such as concrete levelling pads and soldier piles.

Approved Product Drawings means the documentation for an RSS that has been submitted by the manufacturer and accepted by the Ministry for listing in the DSM, according to the Qualification Criteria for RSS.

Backfill for RSS means the material specified by the manufacturer as part of the engineered materials comprising the backfill for the RSS.

Constructed Height means the vertical distance between the foundation for RSS and the top of the currently placed and compacted backfill for RSS, measured at the point of the design height.

Corrective Work means work carried out by the Contractor to repair deficiencies identified by the Owner during the RSS warranty period.

Design Checking Engineer means the Engineer retained by the Contractor who checks the original design and working drawings.

Design Engineer means the Engineer retained by the Contractor who produces the original design and working drawings.

Design Height means the maximum difference in elevation between the foundation for RSS and the corresponding top of backfill for RSS, over the full length or perimeter of the RSS.

External Stability means stability against deep-seated failure of the foundation for RSS, including adequate bearing capacity at specified settlements of the foundation.

Facing Elements means components specified by the manufacturer that delineate the front face of the RSS and to which reinforcing elements may be attached, such as precast concrete panels, split-face concrete blocks, and geo-synthetic panels.

Foundation for RSS means the base on which the RSS is constructed, such as excavation to a specified elevation and construction of a granular pad.

Internal Stability means stability against failure of the engineered materials comprising the RSS, including adequate resistance against excessive elongation, breakage and pullout of the reinforcing elements.

Manufacturer means the firm who supplies the design and proprietary components, and who specifies the backfill and other materials, for the RSS.

Manufacturer's Representative means an individual with continuous full-time employment with the manufacturer for a period of at least three (3) years, and who is knowledgeable in the design and construction of the RSS.

Obstruction means any part of the work and any existing condition within the Working Area that affects the design, construction and performance of the RSS, such as structures, catch basins and manholes, drainage pipes and sewers, and utilities.

Performance Tolerance – Local means the joint gap between any two constructed facing elements, measured at any point along the joint between the facing elements and perpendicular to the line of the joint.

Performance Tolerance – Global means the vector distance between any point on the constructed RSS and the corresponding point on the theoretical RSS surface as defined in the Contract Documents.

Placing Tolerances means tolerances specified by the manufacturer on the placing of the RSS components and backfill for RSS to ensure compliance of the constructed RSS with the performance tolerances.

Reinforcing Elements means components specified by the manufacturer that are placed within the backfill for RSS and connected to the facing elements to mechanically stabilize the backfill for RSS, such as metal tie strips, metal grids and geo-synthetic grids.

Retained Soil System (RSS) means a proprietary system listed in the DSM used to retain horizontal loads for applications such as true and false abutment structures, retaining walls and steep slopes; or, to retain vertical loads for applications such as embankments over soft ground.

RSS Superintendent means the Contractor's authorized representative in responsible charge of the construction of the RSS.

Structure means any bridge, culvert, tunnel, retaining wall, overhead sign, high mast light pole, wharf, dock, or any part thereof.

4.0 DESIGN AND SUBMISSION REQUIREMENTS

4.01 Design

4.01.01 General

The Contractor shall be responsible for the design of the RSS and for ensuring the RSS as designed is compatible with the Work.

The geometric requirements of the RSS, such as lines and grades of the facing elements and typical cross-sections, shall be as specified in the Contract Drawings.

The foundation for RSS shall be as specified in the Contract Documents.

4.01.02 RSS Selection

An RSS shall be selected from the DSM that meets the application, performance and appearance requirements for that RSS, as specified in the Contract Drawings.

An RSS shall be selected from the DSM designated as either 'A' (Accepted) or 'DE' (Demonstration). RSS designated as 'DE' status requires inspection, instrumentation and monitoring of the constructed RSS, and the reporting of the findings to the Ministry by the manufacturer as specified in the Qualification Criteria for RSS.

When there is more than one RSS included in the same tender item number for payment, all RSS for the tender item shall be selected from the same DSM listing, including type and colour of facing elements.

All RSS that abut an existing structure, or a structure to be constructed as part of the Work, and that have the same performance and appearance requirements, shall be selected from the same DSM listing, including type and colour of facing elements.

4.01.03 Performance Tolerances

Performance tolerances for the RSS shall be according to Table 1.

4.01.04 Obstructions

Design details of the RSS shall be included on the Working Drawings for all obstructions shown in the Contract Drawings.

Where an obstruction is shown in the Contract Drawings but not located to sufficient accuracy for the design of the RSS, the obstruction shall be located in the field to sufficient accuracy as required to design the RSS.

4.01.05 Foundation Investigation Report

A Foundation Investigation Report that describes the subsurface conditions at the RSS is available, as specified in the Contract Documents.

The Owner warrants the data in the Foundation Investigation Report, except that interpretations of the data and opinions expressed in the Foundation Investigation Report are not warranted.

4.02 Submissions

4.02.01 Working Drawings

At least two weeks prior to commencement of construction of the RSS, three (3) sets of Working Drawings shall be submitted to the Contract Administrator for information purposes. A separate submission of Working Drawings shall be made for each RSS in the Contract. All submissions shall bear the seal and signature of the design Engineer and the design checking Engineer.

The RSS superintendent shall have a copy of the Working Drawings on site at all times during the construction of the RSS.

4.02.02 Working Drawing Requirements

Working Drawings shall include at least the following:

- a) Statement from the manufacturer confirming the experience and expertise of the design Engineer and design checking Engineer to provide design services for the manufacturer's RSS;
- b) All design, fabrication and construction drawings and specifications for the RSS;
- c) Location and value of the design height of the RSS;
- d) Defined lines and grades, type, and quantity in cubic metres of the backfill for RSS;
- e) Details at obstructions, and connections to other structures, where shown in the Contract Drawings;

- f) Statement of bearing resistance required by the RSS foundation according to CAN/CSA-S6;
- g) Statement of satisfactory internal and external stability; and
- h) Placing tolerances for the RSS.

4.02.03 RSS Superintendent

At least two weeks prior to commencement of construction of the RSS, the name(s) of the RSS superintendent responsible for each RSS in the Contract shall be submitted in writing to the Contract Administrator.

During construction of an RSS, the RSS superintendent shall not change without written permission from the Contract Administrator. A proposal for a change in the RSS superintendent shall be submitted at least one week prior to the actual change in RSS superintendent.

4.02.04 Manufacturer's Representative

At least two weeks prior to commencement of construction of the RSS, the name(s) of the manufacturer's representative for each RSS shall be submitted in writing to the Contract Administrator.

At least 48 hours written advance notice shall be provided to the Contract Administrator prior to each visit to the site by the manufacturer's representative. The advance notice shall include the dates and locations the manufacturer's representative will be on site.

4.02.05 Inspection Report

For each RSS, an inspection report shall be submitted to the Contract Administrator following an inspection by the Contractor's Engineer, who shall be knowledgeable in the design and construction of the RSS, at each of the following milestones, and prior to commencement of subsequent operations on that RSS:

- a) Layout and marking of all lines and grades needed to construct the RSS; and construction of the alignment elements, where applicable;
- b) Delivery and storage on site of facing elements and reinforcing elements, where applicable; and
- c) Installation of the facing elements; placement and compaction of the backfill for RSS; and installation of the reinforcing elements, where applicable.

For RSS where the design height is greater than 5.0 m, the inspection report shall document inspections at the constructed height of the RSS at 5.0 m, 10.0 m, and 15.0 m, as applicable, up to and including the design height.

The inspections and inspection submissions reports in no way supersede the inspection and testing intervals required for the construction of the RSS, as specified in the Working Drawings.

4.02.06 RSS Warranty

A warranty shall be submitted to the Owner to address all deficiencies identified by the Owner related to the performance of the RSS for a period of 36 months from the date of the Contract Completion Certificate.

4.02.07 Repair Procedures for Corrective Work

Three copies of repair procedures for corrective work shall be submitted to the Contract Administrator for information purposes only at least two weeks prior to commencement of any corrective work at an RSS required during the warranty period.

The repair procedures shall include a description of the cause and fully detail the corrective work required to correct the deficiencies identified by the Owner.

The repair procedures shall bear the seal and signature of an Engineer, and be signed by the manufacturer's representative.

5.0 MATERIALS

5.01 General

All materials for the selected RSS shall be according to the approved product drawings for that RSS.

6.0 EQUIPMENT

6.01 Restriction on Skid-Steer Vehicles

Skid-steer vehicles shall not be permitted on any area where the depth of backfill for RSS over installed reinforcing elements is less than 0.5 m.

7.0 CONSTRUCTION

7.01 General

The RSS shall be constructed according to the Working Drawings and this specification.

A Certificate of Conformance for the foundation of the RSS shall be submitted to the Contract Administrator prior to the construction of the RSS.

7.02 RSS Superintendent

The construction of an RSS shall be scheduled such that it is at all times under the responsible charge of an RSS superintendent who has been advised on site by the manufacturer's representative as to the required procedures for the construction of that RSS, for the specified operations and time periods.

7.03 Manufacturer's Representative

The manufacturer's representative shall be on site to oversee installation of the RSS for the manufacturer and to advise the RSS superintendent of the procedures and placing tolerances required for the construction of the RSS according to the manufacturer's requirements as approved on the DSM.

For each RSS, the manufacturer's representative shall be on site at commencement of each of the following operations, for a time period of three (3) Working Days per operation or until the operation is complete, whichever is less:

- a) Layout of the RSS; and construction of the alignment elements, where applicable;

- b) Installation of the facing elements; and
- c) Placement and compaction of the backfill for RSS; and installation of the reinforcing elements, where applicable.

Whenever there is a change in the RSS superintendent during construction of an RSS, the manufacturer's representative shall return to the site for the same operations and time periods as at commencement.

7.04 Backfill for RSS

Backfill for RSS shall be placed within the lines and grades shown on the Working Drawings. All backfill for RSS shall be compacted according to OPSS 501.

Unless otherwise shown in the Contract Drawings, backfill for RSS shall not be placed against an adjacent concrete structure that is part of the work until the concrete in that structure has obtained at least 70% of the compressive strength specified in the Contract Documents.

7.05 Corrective Work

All deficiencies shall be repaired according to the repair procedures for corrective work. All corrective work shall be done within the RSS warranty period, unless prevented by seasonal shutdown, in which case the corrective work shall be done prior to June 30 of the following year.

At least one week prior to commencement of any corrective work, written notice of commencement of work shall be submitted to the Contract Administrator and the Owner.

Access to the corrective work shall be provided for inspection by the Owner when requested.

7.06 Certificates of Conformance

A Certificate of Conformance, upon completion of each RSS, shall be submitted to the Contract Administrator.

7.07 Management of Excess Materials

Management of excess materials shall be according to the Contract Documents.

8.0 QUALITY ASSURANCE

8.01 Acceptance Criteria at End of the RSS Warranty Period

The Owner will accept the RSS at the end of the RSS warranty period if none of the deficiencies listed in Table 2 are found during the warranty inspections. The RSS shall not be accepted until all deficiencies have been repaired by corrective work.

8.02 Warranty Inspections

Throughout the warranty period the Owner will carry out warranty inspections of the RSS for deficiencies according to Table 2. The Owner will notify the Contractor as to the date and time of the inspection(s) and the Contractor may, at his discretion, be present during the inspection(s).

Within two weeks following a warranty inspection the Owner will notify the Contractor in writing of all deficiencies that require corrective work.

9.0 MEASUREMENT FOR PAYMENT

9.01 Actual Measurement

- 9.01.01 Backfill for Retained Soil System, Ultra Lightweight**
- Backfill for Retained Soil System, Lightweight**
- Backfill for Retained Soil System, High Performance**
- Backfill for Retained Soil System, Medium Performance**
- Backfill for Retained Soil System, Low Performance**

Measurement shall be of the mass in tonnes of the material placed within the theoretical lines and grades shown in the stamped Working Drawings. The method of determining the mass shall be as specified in the Contract Documents.

10.0 BASIS OF PAYMENT

- 10.01 Retained Soil System, True Abutment - Item**
- Retained Soil System, False Abutment - Item**
- Retained Soil System, Wall/Slope, High Performance - Item**
- Retained Soil System, Wall/Slope, Medium Performance - Item**
- Retained Soil System, Wall/Slope, Low Performance - Item**
- Retained Soil System with Finishing Cap, Wall/Slope, High Performance - Item**
- Retained Soil System with Finishing Cap, Wall/Slope, Medium Performance - Item**
- Item**
- Retained Soil System, Roadbase Embankment - Item**

Payment at the Contract price for the above tender items shall be full compensation for all labour, Equipment and Material to do the work, including all costs associated with having the manufacturer's representative on site.

Payment for construction of the foundation for RSS shall be made under the appropriate tender items in the Contract.

No payment shall be made for corrective work, including investigation of deficiencies, design of repairs, site access, traffic staging and removal of existing work, except where the corrective work is required as a result other than an act or fault of the Contractor.

- 10.02 Backfill for Retained Soil System, Ultra Lightweight - Item**
- Backfill for Retained Soil System, Lightweight - Item**
- Backfill for Retained Soil System, High Performance - Item**
- Backfill for Retained Soil System, Medium Performance - Item**
- Backfill for Retained Soil System, Low Performance - Item**

Payment at the Contract price for the above tender items shall be full compensation for all labour, Equipment and Material to do the work.

When the Contract does not contain a separate tender item for backfill for RSS, the contract price for the RSS contract items in which the backfill for RSS is incorporated shall include full compensation for all labour, Equipment and Material required to place and compact the backfill for RSS.

**TABLE 1
Performance Tolerances for RSS**

Performance Requirement	Performance Tolerance (mm)	
	Local	Global
Abutments	Joint Gap \pm 5 (Note 1)	\leq 20
High	Joint Gap \pm 10 (Note 1)	\leq 30
Medium	N/A	\leq 50
Low	N/A	\leq 100

Notes:
1. Joint Gap shall be as specified on the Working Drawings.

**TABLE 2
RSS Deficiencies**

Number	Description of Deficiency
1	Performance tolerance exceeds tolerances given in Table 1.
2	Damaged facing elements and damaged alignment elements, where applicable.
3	Dead and dying vegetative elements that are an integral part of the RSS.