

GEOTECHNICAL INSTRUMENTATION

****From Stockbridge BRF 022-1(20)**

- xx. DESCRIPTION. This work shall consist of furnishing, installing, monitoring, and maintaining settlement platforms in accordance with the Contract Documents at the locations shown in the Plans and as directed by the Engineer.
- xx. GENERAL. Data obtained from the Contractor's observations of the response of these instruments, in concert with other data, will give the Engineer a measure of how much settlement has occurred and how much more can be anticipated. Settlement data, as interpreted by the Engineer, will provide the Engineer with information for analysis as to whether or not the embankment is performing as anticipated. The Contractor's attention is directed at proper installation, protection of installed equipment, and coordination of this sensitive work with other construction activities.
- xx. MATERIALS. Materials shall meet the requirements of the following Subsections:

Sand Borrow.....	703.03
Nonstructural Lumber.....	709.02
Timber Preservative.....	726.01
Plastic Pipe, Rigid (PVC).....	740.02
Steel Pipe, Galvanized.....	740.05
High Density Overlaid Plywood.....	750.06
Assembly Hardware.....	750.12

(a) Settlement Platform, Type I.

- (1) Riser Pipe. Riser pipe shall be 76 mm (3 inch) I.D. standard weight pipe conforming to the requirements of Subsection 740.05. Pipe shall be threaded at both ends with lengths not exceeding 1.5 m (5 feet) per section. Pipe shall be furnished with a threaded pipe cap on the top of each riser pipe.
- (2) Lumber. Lumber shall be pressure treated in conformance with Subsection 726.01.

Plywood shall conform to Subsection 750.06 and shall be treated for soil contact retention in accordance with AWWA Standard UC4A.

(b) Settlement Platform, Type IV.

- (1) Vibrating Wire (VW) Settlement and Readout Systems. Materials shall consist of component parts provided by:

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Lebanon, NH 03766
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Website: www.geokon.com

or approved equal.

All materials shall conform to the specifications of, or be equivalent to, the Model 4650 Settlement System as manufactured by Geokon, Inc. Requests to use instrumentation manufactured by others shall be approved by the Engineer in writing a minimum of two (2) weeks prior to beginning installation.

The vibrating wire transducers shall measure over a range of 0-172 kPa (0-25 psi) and shall have the capability to measure temperature. Gas tube discharge electrical surge protection units shall be incorporated inside the body of each transducer. Vibrating wire transducers shall have factory-attached vented electrical cables of sufficient length to route to the terminal box without splicing.

Vibrating wire transducers shall have factory-attached connecting tubes, 2 x 6 mm (2 x ¼") Type II nylon filled with de-aired antifreeze solution, of sufficient length to route to the reservoir without splicing.

- (2) Readout Box. The readout box shall be a Model GK-403 vibrating wire portable readout box as manufactured by Geokon Inc., or approved equal. The same company manufacturing the vibrating wire pressure transducers shall manufacture the readout box. The Contractor shall repair or replace, if necessary, and otherwise maintain the readout system for the duration of the Contract.

xx. SUBMITTALS. The following information shall be submitted to the Engineer for approval a minimum of two (2) weeks prior to beginning settlement platform installation:

- (a) A complete installation schedule of indicated instrumentation, with detailed installation procedures and a complete listing of all materials.
- (b) A list of all settlement systems with the cable and tubing lengths and the proposed procedures and methods for installing the cable and tubing. The method for marking and identifying cables from individual settlement systems shall be clearly identified.
- (c) The manufacturer calibration sheets for all VW transducers. Calibration sheets shall include the zero correction value, the gauge factor, barometric pressure and temperature, and calibration data at the time of manufacture.
- (d) Instrumentation shall be installed by a qualified geotechnical engineer. The geotechnical engineer shall submit examples of three projects of similar scope with descriptions of instrumentation used and shall include the owner's name and contact information.

xx. INSTALLATION.

- (a) General. The Contractor shall survey all geotechnical instrumentation for both location and elevation prior to and immediately after installation. All instrumentation shall be in place and accepted by the Engineer prior to proceeding with Mechanically Stabilized Earth (MSE) retaining wall and embankment construction.
- (b) Settlement Platform, Type I. Type I settlement platforms shall be placed at the locations indicated on the Plans or as directed by the Engineer.

Type I settlement platforms shall be constructed in accordance with the details shown on the Plans. They shall be installed at approximate existing ground levels after removal of all soft loose and/or organic surface materials to the depths directed by the Engineer.

Each platform shall be placed on a 300 mm (1 foot) layer of Sand Borrow extending a minimum of 600 mm (2 feet) beyond the platform at all sides. The Sand Borrow shall be leveled and compacted with hand equipment. If the wood base option is selected, a 300 mm x 300 mm x 6 mm (12 inch x 12 inch x ¼ inch) thick steel plate shall be provided under the plywood, centered on the riser pipe as a bottom flange for the bolted connection. All hardware and bolts shall be galvanized in accordance with AASHTO M 111M/M 111.

Necessary lengths of riser pipes shall be firmly attached to the platforms by means of approved pipe flanges and shall be of sufficient lengths, with pipe extensions, to reach a minimum of 600 mm (2 feet) above the top surface of the embankment at any stage of construction.

The riser pipes shall be accurately and consecutively numbered in 300 mm (1 foot) intervals from the bottom of the settlement platform. The number and graduations shall be marked on the riser pipes by scoring the riser pipe with a pipe cutter and marking the score mark and graduations with quick drying yellow paint immediately after each section of pipe is added.

No extension shall be added to pipes, except in the presence of the Engineer. The uppermost extension of the pipe shall be tightly capped at all times, and the caps shall be removed only in the presence of the Engineer at the time that extensions are added. The interior of the extension pipe down to the platform shall be kept free of dirt and debris in order to allow the checking of the length of extensions above the plate. After the last extension and cap are installed and tightened, the cap shall be marked with paint in order to assure that the cap has not been subsequently moved or removed.

Type I settlement platforms shall be protected against damage from vehicles and construction equipment by surrounding them with a highly visible and sturdy portable fence or barrier. The Contractor shall maintain and keep in good order all settlement platforms and shall notify the Engineer immediately of all repairs to or restorations of damaged or disturbed settlement platforms. All embankment construction within 30 m (100 feet) of

any location where a settlement platform has been disturbed or damaged shall be halted until the Engineer has been notified and the necessary maintenance has been performed. All movement or disturbance of any settlement platform not caused by subsurface consolidation of the compressible foundation soils shall be immediately corrected by the Contractor, at no additional cost to the State, by resetting or replacing it to the satisfaction of the Engineer.

The exact elevation of the top of the settlement platform as installed shall be determined and recorded by the Engineer. No embankment shall be placed within 30 m (100 feet) of such locations before the settlement platform elevation has been determined.

- (c) Settlement Platform, Type IV. Type IV settlement platforms shall be placed at the locations indicated on the Plans or as directed by the Engineer and shall be installed in accordance with the manufacturer's instructions.

The sensor cable which connects to the Field Control Station shall be placed in a trench. The trench shall be backfilled with Sand Borrow and compacted to protect the cable. Each cable shall be clearly marked at the Field Control Station by means of a stamped metal tag.

- xx. MAINTENANCE AND MONITORING. The Contractor shall maintain all geotechnical instrumentation equipment in an acceptable working order for the duration of the project and shall repair or replace any such equipment which fails to function properly, as directed by the Engineer.

Any instrumentation that becomes damaged or inoperable as a result of the Contractor's operations and requires replacement shall be replaced in kind by the Contractor at no cost to the State of Vermont.

The Contractor shall monitor and record elevation data as indicated on the Plans or as directed by the Engineer. Data will be recorded in a format acceptable to the Engineer, and shall be provided on a weekly basis.

- xx. METHOD OF MEASUREMENT. The quantity of Special Provision (Settlement Platform, Type I) and Special Provision (Settlement Platform, Type IV) to be measured for payment will be the number of settlement platforms furnished, installed, monitored, and maintained in the complete and accepted work.

- xx. BASIS OF PAYMENT. The accepted quantity of Special Provision (Settlement Platform, Type I) and Special Provision (Settlement Platform, Type IV) will be paid for at the Contract unit price for each. Payment shall be full compensation for furnishing, transporting, handling, and placing the materials specified, including pipe, clamps, fittings, appurtenances, and protective devices; for protecting and maintaining the platform; for monitoring and recording survey data for each platform; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work. Payment will be made only

if the platform remains fully functional during all phases of construction unless otherwise allowed by the Engineer.

Payment will be made as follows:

- (a) Twenty-five (25) percent of the Contract unit price will be paid when instrumentation has been delivered on-site.
- (b) Fifty (50) percent of the Contract unit price will be paid when instrumentation has been installed and is properly functioning.
- (c) The final twenty-five (25) percent of the Contract unit price will be paid upon completion of the project, or removal/abandonment of the equipment.

At the completion of the project, all geotechnical instrumentation, readout boxes, and appurtenances will become the property of the State of Vermont for continuing to monitor any actual settlement at this location.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
900.620 Special Provision (Settlement Platform, Type I)	Each
900.620 Special Provision (Settlement Platform, Type IV)	Each