
Supplemental Technical Specification for

Slope Inclinometer Casing

SCDOT Designation: SC-M-203-9 (07/17)

1.0 DESCRIPTION

1.1. Furnish all necessary supervision, labor, material, equipment, and related services necessary to furnish, install and maintain slope inclinometer casings in accordance with the lines, grades, dimensions, and designs shown on the plans, this Supplemental Technical Specification (STS), the project Specifications or Special Provisions, or as directed by the Resident Construction Engineer (RCE) or Geotechnical Engineer-of-Record (GEOR). This item includes the furnishing of "As-Built" drawings of actual locations where instrumentation was installed, survey data recorded (i.e. the elevations of the slope inclinometer casings obtained during casing installation), and installation field reports. Also included in this item of work is the initial and periodic/continuous access to the slope inclinometer casing by either the RCE or GEOR in order to obtain readings in accordance with the Department's Geotechnical Instrumentation Monitoring Plan for the entire duration of the project, unless otherwise directed. Install slope inclinometer casings in the presence of the RCE and/or the GEOR.

1.2. The slope inclinometer locations and the casing depths are indicated in the project plans.

1.3. The project geotechnical conditions and data including geotechnical boring logs, laboratory testing results, and other pertinent information are available upon request from the RCE. All interpretation of geotechnical conditions and data relevant to the location and depth the slope inclinometer casings are installed is the responsibility of the GEOR.

2.0 MATERIALS

2.1. The inclinometer casing shall be made of ABS plastic (acrylonitrile butadiene styrene) and shall have an outside diameter (OD) ranging from 2-1/2 to 3-1/2 inches with a casing wall thickness ranging from 22/100 to 23/100 of an inch. The casing shall have 4 internal grooves located 90° apart (see Figure 1). Each groove shall provide a regular, flat surface for the wheels of the probe (see Figure 2). The grooves shall be slightly wider than the probe wheels, to permit some side to side movement as the probe passes through curves.

2.2. The connections between individual pieces of inclinometer casing shall be waterproof and may consist of either screw type threads or may be glued together using glue appropriate for the casing material.

3.0 SUBMITTALS

3.1. **Slope Inclinometer Casing Installation Plan:** At least 30 calendar days before installing the slope inclinometer casing, submit to the RCE and GEOR for review the personnel qualification and installation plan. Include in the installation plan as a minimum the following information:

1. The manufacturer's Specification sheet for the proposed slope inclinometer system

- for review and acceptance by the GEOR. Coordinate with the RCE or the GEOR on the OD of the inclinometer casing so that slope inclinometer casing and the slope inclinometer instrument will work together.
2. Submit locations where slope inclinometers will be installed if different from the location shown on the plans. Prior approval of new locations by the GEOR is required.
 3. Proposed installation method.
 4. Proposed method to protect the slope inclinometer during construction from construction equipment, vandalism, and weather.
 5. Identify the licensed surveyor who will be responsible for providing survey services during the installation of the slope inclinometer casings to include staking out the proposed slope inclinometer casing locations and providing as-built locations and elevations of all slope inclinometers casing locations.
 6. Select a Geotechnical Engineering Consultant (GEC) to install the slope inclinometer casings. The GEC shall be selected from those firms who are currently on the SCDOT Geotechnical On-Call Contract. Contact the RCE for the list of GEC firms or see the SCDOT website for the current list of Geotechnical On-Call Contracts. Document the GEC's experience in installing slope inclinometer casings in accordance with the plans and Contract Documents. The documentation shall include a project summary, of at least 3 projects, that includes for each project the project name, role in providing instrumentation services, type of slope inclinometer casing, equipment used, duration of the project (i.e. dates), magnitude of displacements (lateral and vertical), client name and address, name and phone number of representative of the consultant and owner for whom the work was performed and who can attest to the successful completion of the work, and any other information relevant to demonstrating the geotechnical engineer's qualifications.
 7. The selected GEC shall provide no later than 7 calendar days after completion of the slope inclinometer casing installation a soil test boring log indicating the soils encountered during the installation. Soil sampling and soil test boring log format shall comply with the requirements of the SCDOT Geotechnical Design Manual.

3.2. The manufacturer/supplier shall be available during the initial installation of the slope inclinometer to answer any questions during installation. The manufacturer/supplier shall also be available for questions from either the GEC responsible for maintaining the slope inclinometer casings or from the GEOR concerning the data being collected.

3.3. Submittal Reviews: Acceptance of the personnel qualification and the installation plan by the GEOR shall not relieve the Contractor of its responsibility to successfully install the slope inclinometers in accordance with the plans and specifications. Approval by the GEOR of the Slope Inclinometer Casing Installation Plan shall be contingent upon satisfactory demonstration that the slope inclinometer casings meet the objectives of the Department's Geotechnical Instrumentation Monitoring Plan. If, at any time, the GEOR in consultation with the RCE considers that the slope inclinometer casings do not produce satisfactory results, alter the method and/or equipment as necessary to comply with this STS and Department's Geotechnical Instrumentation Monitoring Plan. The RCE and the GEOR will be the sole judge in determining the adequacy of the Contractor's slope inclinometer casings.

3.4. Within 1 week following installation, submit an installation record for each slope inclinometer casing, which includes the slope inclinometer designation, station, offset, and elevation of the top of the slope inclinometer casing. Prepare and provide to both the RCE and the GEOR a plan indicating the slope inclinometer designation, station, offset as well as the location to an unmoving benchmark. Locate the slope inclinometer casing to an accuracy of

0.01 feet (both vertically and horizontally). Establish the benchmark on stable ground that is not subject to settlement and is typically located away from any earthwork/construction activities.

4.0 DELIVERY, STORAGE, AND HANDLING

4.1. Check all materials and equipment upon delivery to ensure that the proper items are received and are not damaged. Store and maintain all materials in a clean, uncontaminated condition throughout the course of the project. Upon receipt of the slope inclinometer casings, submit copies of the manufacturer's installation and instruction manual for review and acceptance by the GEOR.

5.0 CONSTRUCTION REQUIREMENTS

5.1. Notify the GEOR at least 14 calendar days prior to the installation of slope inclinometer casings. The slope inclinometer casings shall be furnished and installed by the Contractor in accordance with the plans and this STS and in the presence of the GEOR or the RCE.

5.2. Locate all slope inclinometers in the field and ensure that no conflicts exist between slope inclinometers and foundations, structures, utilities or other construction proposed or present at the site.

5.3. Accurately locate all slope inclinometer casings in accordance with the plans. Slope inclinometer casings may be adjusted by the Contractor, with the prior written approval of the GEOR, to avoid utilities, foundations, and all other underground construction.

5.4. Install slope inclinometer casings prior to construction of the embankment. Install slope inclinometers in accordance with the manufacturer's recommendations as presented in their instruction and installation manual. Extend all slope inclinometer casings as embankment construction progresses. Maintain the top of the casing above the exposed subgrade. The top of the casing shall not be more than 5 feet above the exposed subgrade.

5.5. Install slope inclinometer casings so that 1 pair of grooves (i.e. grooves that are 180° apart) is perpendicular to the constructed slope.

5.6. Protect slope inclinometer casing locations from damage and vandalism for the duration of the Contract and repair or replace damaged or inoperative slope inclinometer casings at no cost to the Department that is not caused by slope movement.

6.0 ABANDONMENT OF SLOPE INCLINOMETER

6.1. Once the GEOR has determined that the slope inclinometer casings have served their purpose and are no longer needed, the slope inclinometer casings shall be abandoned in-place. Remove recoverable portions of the slope inclinometer casing. All recoverable casing shall remain property of the Contractor. Seal the slope inclinometer casing left in place or the void left behind by the removal of the slope inclinometer casing using a lean grout mix.

7.0 METHOD OF MEASUREMENT

7.1. The number of slope inclinometer casings provided in the plans, will be paid for at the contract unit price bid for "Slope Inclinometer Casing" which shall include all equipment, including but not limited to the slope inclinometer casing; mobilization; labor; surveys; materials; incidentals and abandonment required by this STS and as outlined in the Geotechnical Instrumentation and Monitoring Plan. Payment will not be made for slope inclinometer casings

that are installed incorrectly or are rejected for their inability to perform, or do not meet the requirements in the plans and these specifications.

8.0 BASIS OF PAYMENT

8.1. The price and payment for this work shall be full compensation for furnishing the necessary slope inclinometer casings as indicated in and accepted by the Section 7.0 – Method of Measurement of this STS.

8.2. Payments shall be made under:

Item No.	Pay Item	Pay Unit
2038120	Monitoring Device – Slope Inclinometer Casing	EA



Figure 1

(<http://www.gage-technique.com/inclinometer-casing.htm>)

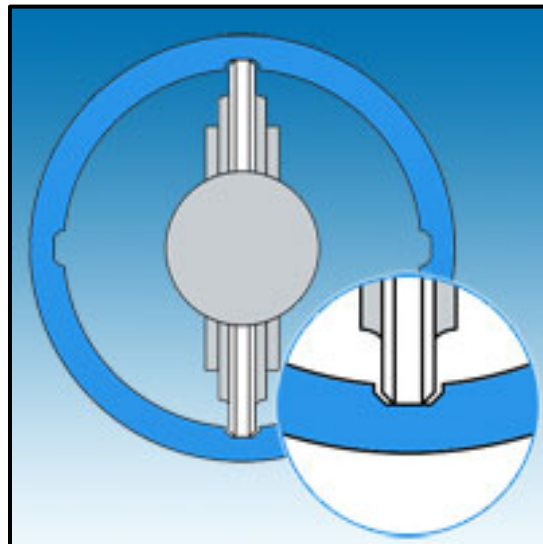


Figure 2

(<http://slopeindicator.com/instruments/inclin-casing.php>)