

July 1, 2017

SECTION 105: AUTOMATED MACHINE GUIDANCE -DBB

General

Section 105.8 of the Standard Specifications is amended by adding the following:

This Supplemental Specification describes the process required in order for the Contractor to utilize Automated Machine Guidance (AMG) on design-bid-build Projects, and to ensure that the end results generated by equipment using AMG are in conformance with the tolerances required for conventional stakeout.

Those areas not covered by this special provision are subject to the requirements of Subsection 105.8.

The Contractor is responsible for all errors resulting from the use of AMG. Correct all deficiencies to the satisfaction of the RCE at no additional cost to the Department.

EQUIPMENT

Provide all equipment required to accomplish AMG. Use equipment that generates end results meeting the current Standard Specification for Highway Construction and all applicable supplemental specifications and special provisions.

CONSTRUCTION

1. The Department will provide electronic engineering data (EED) files upon advertisement at: <https://www.scdot.org/business/constructionletting-extranet.aspx>. The provided files will be generated with the computer software applications MicroStation (CADD software) and GEOPAK (civil engineering software). The EED files will contain the following information and be in the native formats and other software formats as described below. The contractor will perform necessary conversion of the data files for the selected grade control equipment.
 - a. Survey Controls:
 - Control points
 - Bench marks
 - Project datum and scale factors
 - b. CADD Files:
 - MicroStation design file for plans, profiles, and other 2D linear features
 - MicroStation design files for cross sections
 - GEOPAK GPK file
 - c. Data Files:
 - Alignment Report
 - Cross Section Report
 - Horizontal Alignments in LandXML format
 - Vertical Alignments in LandXML format
 - Existing DTM in LandXML format

The Department makes no guarantee that the EED files provided by the Department will be directly compatible with Contractor's systems. Information shown on the plans takes precedence over the provided electronic data. Provision of this information after award in no way relieves the Contractor from the responsibility of investigating conditions that could be encountered. The Department assumes no risk or responsibility for any use of this EED files.

2. Where electing to use AMG, use the EED files provided by DOT to import and develop a 3D AMG model of the finish grade surfaces and linework drawings. Submit to the RCE the 3D surfaces in LandXML format and linework in DGN or DXF format. Submit to the RCE a centerline and profile verification report that records differences between the developed 3D model and provided EED.

Provide to the RCE with a minimum of three hours of information exchange meeting and demonstrations about the 3D model builder software, work flow, data exchange, and quality control process. If the 3D AMG model is revised during construction, also submit the revised model to the RCE.

3. At least 14 days prior to use AMG, submit to the RCE a written AMG work plan which includes:
 - a. Location and scope of work to be completed using AMG.
 - b. A description of the manufacturer, model, and control software version of the AMG equipment.
 - c. A description of how the proposed additional (new) project control points will be established and a map showing their locations.
 - d. Completed SCDOT Survey Control Plan Form.
 - e. Project site calibration procedures, including equipment calibration and calibration frequency.
 - f. A description of the setup of the GPS system, laser system, sonic systems, and/or robotic total stations to be used.
 - g. Designation of a single staff person as the primary contact for GPS technology issues.
 - h. PE or PLS seal and signature.
4. Prior to use of AMG, construct a test section for work to be completed (in the final footprint of the roadway) with AMG to demonstrate to the RCE that the system has the capability to achieve acceptable results. Make the test section at least 500 feet in length. If acceptable results are not achieved, make necessary adjustments and rework the test section to the satisfaction of the RCE.
5. Upon request by the RCE, provide a GPS rover, including a data collector loaded with 3D models including surfaces, break lines, and alignments, with the same capabilities as units used by the Contractor for the RCE's use for the duration of the contract. The GPS rover unit will remain property of the Contractor. Provide the RCE and/or RCE's representatives with a minimum of eight hours of formal training on the use of the GPS rover unit and Contractor's AMG systems. Formal training will be provided by a manufacturer certified trainer and will include, but not be limited to, hardware, software, GPS localization/calibration, and operation of the rover unit. If Contractor elects to use a GPS base and radio link setup, sufficient radio signal strength coverage for the GPS corrections to the GPS rovers is essential. Use of a "repeater" radio may be required to supplement the radio signal to achieve coverage. Coordination with the RCE or his representative should occur so that sufficient radio coverage is provided daily for operations of both the Contractor and the Department.
6. The RCE may perform spot checks of the machine control grading results, surveying calculations, records, field procedures, and actual staking as the RCE deems necessary. If the RCE determines the work is not being performed in a manner that will assure accurate results, the RCE may order such work to be redone to the requirements of the contract documents at no additional cost to the Department. At minimum, check, and if necessary, recalibrate the AMG system at the beginning

SUPPLEMENTAL SPECIFICATION

of each work day and any time the results are suspected of being out of conformance with the specifications. Calibration results and out of tolerance checks will be provided to the RCE.

7. Establish supplemental project control as needed for AMG operations. At minimum, establish secondary control points at appropriate intervals along the length of the project at intervals not to exceed 1000 feet. Establish the horizontal position of these points using methods where the relative horizontal accuracy meets the Class A Urban Survey accuracy standard (*Standards of Practice Manual for Surveying in South Carolina*). Establish the elevation of these control points using differential or trigonometric leveling from the project benchmarks with maximum allowable error of $0.05\sqrt{L}$, where L is the length of level run in miles. Provide a digital copy of all new control point information to the RCE. Department review of control point information in no way relieves the Contractor for responsibility for any and all errors resulting from their efforts. Correct all deficiencies to the satisfaction of the RCE at no additional cost to the Department.
8. Provide a clearly marked station stake at a minimum of every 500 feet on an offset from the edge of pavement as specified by the RCE.

METHOD OF MEASUREMENT

The use of AMG will be considered incidental to the project, and therefore, there is no specific measurement of quantities for this item.

PAYMENT

The use of AMG is incidental to other project costs. No additional payment will be made for the use of AMG.