



**DEVELOPMENTAL SPECIFICATIONS
FOR
GLOBAL POSITIONING SYSTEM MACHINE CONTROL GRADING**

**Effective Date
November 18, 2008**

THE STANDARD SPECIFICATIONS, SERIES 2001, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE DEVELOPMENTAL SPECIFICATIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

01119.01 GENERAL.

This specification contains requirements for grading construction utilizing Global Positioning System (GPS) machine control grading techniques and shall be used in conjunction with Section 2526, of the Standard Specifications.

The Contractor may utilize grading equipment controlled with a GPS machine control system in the construction of the roadway embankment.

The plans indicate the areas of the project where the Contracting Authority is providing electronic surface models of the roadway embankment construction. The remaining areas may be constructed with conventional construction survey techniques unless the Contractor chooses to build the required surface models to facilitate GPS machine control grading for those areas at no additional cost to the Contracting Authority.

The Contractor may use any type of GPS machine control equipment and systems that results in achieving the existing grading requirements. The Contractor shall convert the electronic data provided by the Contracting Authority into the format required by their system.

01119.02 EQUIPMENT.

All equipment required to accomplish GPS machine control grading shall be provided by the Contractor and shall be able to generate end results that meet the Standard Specifications.

01119.03 CONSTRUCTION.

A. Contracting Authority Responsibilities.

1. The Engineer will set the initial horizontal and vertical control points in the field for the project as indicated in the contract documents.
2. The Engineer will provide the project specific localized coordinate system. The control information utilized in establishing the localized coordinate system, specifically the rotation, scaling, and translation can be obtained from the Engineer upon request.

3. The Contracting Authority will ~~provide~~ make available the data listed below in an electronic format ~~with the proposal form~~. This information is available for a fee at: <http://www.ia.bidx.com/main/index.html>. The Contractor will be required to purchase an online account to obtain the electronic data.

No guarantee is made that the data systems used by the Engineer will be directly compatible with the systems used by the Contractor.

Article 1105.04 of the Standard Specifications shall apply with the additional clarification that information shown on the plans shall govern over the provided electronic data.

This information shall not be considered a representation of actual conditions to be encountered during construction. Furnishing this information does not relieve the Contractor from the responsibility of making an investigation of conditions to be encountered including, but not limited to site visits, and basing the bid on information obtained from these investigations, and the professional interpretations and judgment of the Contractor. The Contractor shall assume the risk of error if the information is used for any purposes for which the information was not intended.

Any assumptions the Contractor makes from this electronic information shall be at their risk. The Contracting Authority will develop and ~~provide~~ make available electronic data to the Contractor for review as part of the contract documents. The Contractor shall independently ensure that the electronic data will function in their machine control grading system.

The files that are ~~provided~~ made available were originally created with the computer software applications MicroStation (CADD software) and GEOPAK (civil engineering software). The data files will be ~~provided~~ in the native formats and other software formats as described below. The Contractor shall perform necessary conversion of the files for their selected grade control equipment. The Contracting Authority will ~~furnish~~ make available to the Contractor ~~with~~ the following electronic data files:

- a. CAD Files:
 - GEOPAK TIN files representing the design surfaces.
 - GEOPAK GPK file containing all horizontal and vertical alignment information.
 - GEOPAK documentation file describing all of the chains and profiles.
 - MicroStation primary design file.
 - MicroStation cross section files.
 - MicroStation ROW data file.
 - MicroStation photogrammetry and text files.
- b. Machine Control Surface Model Files:
 - ASCII format.
 - LandXML format.
 - Trimble Terramodel format.

Note: TIN files and surface model files of the proposed finish grade include the topsoil placement where required in the plans.

- c. Alignment Data Files:
 - ASCII format.
 - LandXML format.
 - Trimble Terramodel format.

4. The Engineer may perform spot checks of the Contractor's machine control grading results, surveying calculations, records, field procedures, and actual staking. If the Engineer determines that the work is not being performed in a manner that will assure accurate results,

the Engineer may order the Contractor to redo such work, to the requirements of the contract documents, at no additional cost to the Contracting Authority.

B. Contractor's Responsibilities.

1. The Contractor shall provide the Engineer with a GPS rover for use during the duration of the contract. At the end of the contract, the GPS rover unit will be returned to the Contractor. This unit shall have the same capabilities as units utilized by the Contractor. The Contractor shall provide 8 hours of formal training on the Contractor's GPS machine control systems to the Engineer.
2. The Contractor shall review and apply the data provided by the Contracting Authority to perform GPS machine control grading.
3. The Contractor shall bear all costs, including but not limited to the cost of actual reconstruction of work, that may be incurred due to errors in application of GPS machine control grading techniques. Grade elevation errors and associated quantity adjustments resulting from the Contractor's activities shall be at no cost to the Contracting Authority.
4. The Contractor shall convert the electronic data provided by the Contracting Authority into a format compatible with their system.
5. The Contractor understands that any manipulation of the electronic data provided by the Contracting Authority shall be taken at their own risk.
6. The Contractor shall check and recalibrate, if necessary, their GPS machine control system at the beginning of each work day.
7. The Contractor shall meet the same accuracy requirements as conventional grading construction as detailed in the Standard Specifications.
8. The Contractor shall establish secondary control points at appropriate intervals and at locations along the length of the project and outside the project limits and/or where work is performed beyond the project limits as required at intervals not to exceed 1000 feet (300 m). The horizontal position of these points shall be determined by static GPS sessions or by traverse connection from the original baseline control points. The elevation of these control points shall be established using differential leveling from the project benchmarks, forming closed loops. A copy of all new control point information shall be provided to the Engineer prior to construction activities. The Contractor shall be responsible for all errors resulting from their efforts and shall correct deficiencies to the satisfaction of the Engineer and at no additional cost to the Contracting Authority.
9. The Contractor shall preserve all reference points and monuments that are established by the Engineer within the project limits. If the Contractor fails to preserve these items they shall be reestablished by the Contractor shall reestablished at no additional cost to the Contracting Authority.
10. The Contractor shall set hubs at the top of the finished subgrade at all hinge points on the cross section at 1000 foot (300 m) intervals on mainline and at least two cross sections on the side roads and ramps. These hubs shall be established using conventional survey methods for use by the Engineer to check the accuracy of the construction.
11. The Contractor shall provide controls points and conventional grade stakes at critical points such as, but not limited to, PC's, PT's, super elevation points, and other critical points required for the construction of drainage and roadway structures.

12. At least one week prior to the preconstruction conference, the Contractor shall submit to the Engineer for review a written machine control grading work plan which shall include the equipment type, control software manufacture and version, and the proposed location of the local GPS base station used for broadcasting differential correction data to rover units.

01119.04 METHOD OF MEASUREMENT.

The bid item for GPS Machine Control Grading will be measured and paid for at the lump sum contract price.

01119.05 BASIS OF PAYMENT.

The bid item for GPS Machine Control Grading will be paid for at the lump sum contract price. This payment shall be full compensation for all work associated with preparing the electronic data files for use in the Contractor's machine control system, the required system check and needed recalibration, training for the Engineer, and all other items described in Article 01119.03, B of this Developmental Specification.

Delays due to satellite reception of signals to operate the GPS machine control system will not result in adjustment to the "Basis of Payment" for any construction items or be justification for granting contract extensions.