

REVISION OF SECTION 625
SURVEY CONTROL OF GRADING BY GPS OR RTS METHODS

Section 625 of the Standard specifications is hereby revised for this project as follows:

Subsection 625.01 shall include the following:

The Contractor may use grading equipment controlled by Global Positioning System (GPS) machine control grading techniques or Robotic Total Station (RTS) equipment to control the construction of subgrade, subbase, base course and other roadway structure materials and in construction of ditches and other planned excavations and embankment designated on the project.

Subsection 625.02 shall include the following:

When used, equipment required to accomplish GPS or RTS machine control grading shall be provided by the Contractor and shall be able to generate end results that meet the Contract requirements.

When the Contractor uses automated controlled equipment, the Contractor shall furnish a GPS Rover or RTS equipment to the Engineer for review of the work. With the equipment, the Contractor shall provide eight hours of formal training on the use of the GPS or RTS and the Contractor's systems to CDOT project personnel prior to beginning any grading. This training is for the purpose of providing CDOT project personnel with an understanding of the equipment, software, and electronic data being used by the Contractor. The GPS Rover or RTS equipment will be returned to the Contractor upon completion and acceptance of the final as constructed grade report.

The Contractor may use any type of approved GPS or RTS equipment that achieves the horizontal and vertical tolerances specified in the CDOT Survey Manual.

Add subsection 625.051 immediately following subsection 625.05 as follows:

625.051 Use of GPS or RTS Equipment in Lieu of Conventional Staking. The plans may indicate areas of the project where CDOT is providing electronic surface models. The Contractor shall convert electronic data provided by CDOT for these areas into the format required by the Contractor's system and equipment at the Contractor's expense. Work performed using GPS or RTS equipment shall conform to the plan typical sections. The remaining areas shall be constructed with conventional construction survey techniques and stakes unless the Contractor chooses to develop and submit a Digital Terrain Model (DTM) to the Engineer for review. The Contractor shall develop the DTM using the Contract Documents and any CDOT furnished DTM data. Changes in the given electronic data shall not be made unless approved by the Engineer in writing. To use any CDOT furnished DTM data, the Contractor shall release CDOT and its employees from all liability for the accuracy of the data and its conformance to the Contract.

The Contractor shall perform three 500 foot test sections with the selected GPS or RTS system to demonstrate that the Contractor has the capabilities, knowledge, equipment, and experience to properly operate the system and meet acceptable tolerances. If the Contractor fails to demonstrate this ability, the Contractor shall construct the project using conventional surveying and staking methods.

The Engineer may review the Contractor's machine control grading results, surveying calculations, records, field procedures, and actual staking at any time. If the Engineer determines the work is not meeting the required horizontal and vertical tolerances, the Contractor shall redo such work to the requirements of the Contract at the Contractor's expense.

REVISION OF SECTION 625
SURVEY CONTROL OF GRADING BY GPS OR RTS METHODS

The Contractor shall provide stakes at all alignment control points, at every 500 foot stationing, and where required for coordination activities involving environmental agencies and utility companies at the Contractor's expense.

At least one week prior to the Preconstruction conference, the Contractor shall submit to the Engineer, for review, a written GPS or RTS machine control grading work plan which shall include:

- (1) Equipment type
- (2) Control software manufacturer
- (3) The control software version
- (4) Primary survey control to be used along with the locations of the GPS base stations used for broadcasting differential correction data to the rover units.

Contractor delays due to operating the GPS or RTS machine control system will not result in adjustment to the bid price or quantity of any construction items or be justification for granting any type of contract extension.

Subsection 625.07 shall include the following:

When GPS or RTS methods are used for any of the construction surveying, a Professional Land Surveyor (PLS) or Professional Engineer (PE) licensed in Colorado shall be provided by the Contractor to furnish an interim earthwork quantity report to the Engineer prior to 20 percent completion of the planned earthwork in any phase. Prior to beginning work on any subsequent operation the Contractor's PLS or PE shall certify in writing to the Engineer that the final grade is within specified tolerance.

Delete subsection 625.12 and replace with the following:

625.12 Construction surveying will not be measured, but will be paid for on a lump sum basis, regardless of whether conventional surveying, GPS, RTS, or a combination of these methods is used.

Subsection 625.13 shall include the following:

When GPS or RTS methods are used for any of the construction surveying, the Contract lump sum price bid shall include full compensation for all such surveying work including but not limited to:

- (1) Materials
- (2) Equipment
- (3) Labor
- (4) Office work - preparing the electronic data files for use in the Contractor's machine control grading system, developing or building a DTM to facilitate the GPS machine control grading system, and all other calculations required to complete the work.
- (5) Test section as specified by the Engineer.
- (6) Training for CDOT project personnel,
- (7) Final as constructed grade report

INSTRUCTIONS TO DESIGNERS (delete instructions and symbols from final draft):

This is a pilot project special provision that is to be used only on selected projects. Submit proposed pilot projects to the Staff Survey Coordinator for review early in design prior to using this special provision.

Include this special provision on projects on which a digital terrain model (DTM) has been developed for all or part of the work and the Contractor will be allowed to use Global Positioning System (GPS) machine control grading techniques or Robotic Total Station (RTS) equipment to control construction. The plans should clearly show the areas where a DTM has been developed. List the DTM in the special provision, *Revision of Section 102 – Project Plans and Other Data*, as part of the computer information available.