

Memorandum

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To: DEPUTY DISTRICT DIRECTORS, Construction
DEPUTY DIVISION CHIEFS, Structure Construction
CONSTRUCTION MANAGERS
SENIOR CONSTRUCTION ENGINEERS
RESIDENT ENGINEERS

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File: Division of Construction
CPD 13-10

From: MARK LEJA, Chief
Division of Construction



Subject: Implementation of Automated Machine Guidance for Ongoing Projects

This directive provides guidance to the resident engineer regarding the contractor's option to request and obtain from Caltrans the original ground digital terrain model (DTM) and digital design model (DDM), or the electronic design files for the contractor to create a DTM and DDM, so that automated machine guidance (AMG) systems may be used on a project. AMG is a technology that is becoming an industry standard for earthmoving on private and public works projects. AMG is used on bulldozers, scrapers, blades, loaders, etc. Some paving equipment may use AMG techniques.

AMG uses positioning devices, singly or in combination, such as global positioning systems (GPS), global navigation satellite systems (GNSS), total stations, and rotating laser levels to display the three-dimensional (3D) location of the working surface onboard the operated equipment. The equipment operator observes both the real-time 3D position of the equipment and a 3D DDM, stored by the onboard computer, representing the planned design surface. The operator controls the equipment to perform grading or paving operations using multiple perspectives and comparison graphics to shape the constructed surface to match the planned design surface.

A trained operator using AMG can perform grading or paving operations with increased safety, efficiency, and accuracy along with less dependency on grade checkers, reference stakes, and other types of surface control. Use of AMG has the potential to improve design, survey, and construction methods resulting in improved quality and decreased project duration and cost.

The contractor's use of AMG is optional because of the necessary investment in add-on equipment and specialized operator training. It is most suitable for projects with major earthmoving or paving operations. Use of AMG reduces the amount of traditional construction staking, but does not eliminate it.

To assist in the implementation of AMG on projects, refer to Chapter 12, "Construction Surveys," of the *Surveys Manual*. The Division of Design is increasing the use of 3D modeling among designers with Computer-Aided Civil Engineering Visual Transportation or Civil 3D software. More and more projects will have electronic design data available for contractors to use with AMG. Attached is the recently issued Project Delivery Directive PD-06, "Sharing Electronic Files," which provides policy on the sharing of electronic files with contractors on

Caltrans projects. In the future, AMG will be addressed in the specifications and electronic design data will be provided to bidders as part of the project information available pre-bid.

Transition Period Procedure

On projects where electronic design data is not available to bidders pre-bid, the contractor may request the data during construction. If the contractor requests electronic design data, check with the project engineer to find out if it is available. If the electronic design data is available and of the same level of quality required for the rest of the contract documents, then provide the data to the contractor. A change order is necessary when providing electronic design data to the contractor to define the terms and conditions for use of the data. If the data cannot be provided, the contractor still has the option to develop a DTM and DDM from information on the project plans.

Using AMG on construction projects should reduce costs for the contractor and should reduce support costs for Caltrans if implemented properly. It is important to have a preconstruction meeting about AMG attended by the resident engineer, field engineers, project engineer, data preparer, surveyors, contractor, and subcontractors. At the preconstruction meeting, the resident engineer and contractor will discuss and agree on how to handle the following:

- Discrepancies and errors discovered in the plans and electronic files.
- Project control and GPS calibrations.
- Shoulder and gore construction.
- Cross checks between electronic design data and surveyors data.
- Amount and type of construction staking.
- Project inspection.

There will be no cost or credit to the state and no contract time extension for implementing the contractor-requested change order. A sample change order memorandum, sample change order, and a Federal Highway Administration (FHWA) blanket prior approval for providing electronic design data to the contractor are attached. This directive serves as the delegation of authority from Division of Construction and approval from FHWA for change orders implemented under its requirements.

For additional information or assistance, please contact Jim Cotey, Division of Construction, at jim.cotey@dot.ca.gov or (916) 227-5709.

- Attachments:
1. Project Delivery Directive PD-06, "Sharing Electronic Files"
 2. Sample Change Order Memorandum
 3. Sample Change Order
 4. FHWA Form CA-358 (c), "Record of Blanket Prior Approval for Major Contract Change Order"