

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
AUTOMATED MACHINE GUIDANCE

DES:AB

1 of 3

APPR:DMG:LLR:03-27-23
FHWA:APPR:03-31-23

a. Description. The Contractor may elect to utilize automated machine guidance (AMG) to determine three-dimensional locations for earth work activities and material placement. AMG is the process of automatically adjusting the motion of a machine with an onboard computer that obtains its position from global positioning systems, robotic total stations, lasers, or combinations of similar methods while referencing the Contractor's model developed for the project. This procedure can be used in operations such as earth excavation, material placement, grading, trimming, and/or paving.

b. Materials. None specified.

c. Construction.

1. AMG Intent. The Contractor will notify the Engineer of the intent to use AMG within 10 calendar days of award.

2. AMG Work Plan. If AMG will be used, provide an AMG work plan to the Engineer at least 2 weeks prior to the start of AMG operations. The use of AMG may require conventional staking if the intent to use AMG is submitted after operations have commenced.

Each Contractor using AMG will provide an AMG work plan to indicate the items of work covered within subsections 824.03.E and/or 824.03.F of the Standard Specifications for Construction, type of AMG procedure, anticipated accuracy of each operation, and any areas where AMG operations need to be supplemented with conventional staking. The AMG work plan must identify the Contractor's past experience with AMG operations, model revision procedure(s), description of AMG equipment, equipment calibration procedures, equipment calibration frequency, and a description of the control necessary to support the proposed AMG operation(s). The AMG work plan must designate a primary AMG contact. The Engineer reserves the right to request additional information or clarification prior to the approval of the AMG work plan.

3. Survey Meeting. At the discretion of the Engineer, a meeting with the Contractor and other involved parties (e.g., MDOT personnel, designer of record/representative, AMG contact, Contractor's model creator, surveyors, inspectors, etc.) may be held prior to field operations. The purpose of the meeting is to discuss the implementation of the AMG work plan and exchange of electronic data between both parties. The Contractor must explain the operations and procedures for the AMG technology, discuss the development of the Contractor's model, and present their survey control plan. The meeting attendees may also discuss the workflow for field verification, steps to be taken to resolve concerns with the Contractor's model, and compliance of AMG operations with the contract.

4. Contractor Model.

A. Transmit, to the Department a certification statement which states in part the following: "The Contractor's model(s) developed for the project is(are) an accurate representation of the contract, submittal of this certification is in accordance with the Contractor's obligations and requirements within the Contractor Staking Quality Control Plan and approved AMG work plan.

B. The Contract and Reference Information Documents (RID). Create the model based upon the contract. RID reference documents for the project may be used for creation of the model at the Contractor's discretion. Bring any conflicts identified between the contract and RID documents to the attention of the Engineer. If the Contractor determines a need for additional data or requires electronic formatting of files different than provided, it is the responsibility of the Contractor to prepare such files prior to commencement of the AMG operation without additional costs to the contract.

C. Liability and Verification. The contract will govern construction activities. The Department will not approve the Contractor's model(s). The Contractor accepts all liability associated with the creation and use of the Contractor's model. Field verify existing project features to determine the suitability of any provided contract information. Features to be verified include, but are not limited to, ties at project limits, bridges, ramps, control points, benchmarks, section corners, monuments, and other critical locations.

D. Sharing and Maintenance. Provide the model or phased model as outlined in the approved AMG work plan to the Engineer at least 10 calendar days prior to the start of any AMG operations: Submit 3D Line String Models in Drawing Exchange Format (DXF) and Triangle Models in an Extensible Markup Language (XML) using file naming consistent with the [Contractor Standard Naming Conventions for Document Submittals](#). If changes are made to the model(s) during the course of construction, submit the revised model(s) to the Engineer in accordance with the model revision procedure(s) outlined in the approved AMG work plan.

5. Control.

A. Contractor Staking. The Engineer will provide horizontal and vertical control points, in accordance with subsection 824.03.A of the Standard Specifications for Construction, to be verified by the Contractor prior to the commencement of any AMG operations. Notify the Engineer if any control points exceed the tolerances established in section 824 of the Standard Specifications for Construction.

If the Contractor's AMG operation requires a greater density of control than that provided from the Engineer, the Contractor is responsible for densification of the AMG control. Establish the additional AMG control with sufficient frequency and precision to adequately support the AMG operation being performed. Ensure the control points are stable and properly marked to allow verification activities to be performed by the Engineer. Submit initial AMG control information (Point, Northing, Easting, Elevation, and Description) to the Engineer at least 2 calendar days prior to AMG operations. Ensure any subsequent AMG control information is provided in the same format and time consideration.

The Contractor must provide and maintain one set of stakes denoting control points (subsection 824.03.C of the Standard Specifications for Construction) and every 200 feet

with the station and offset clearly labeled for each roadway alignment.

B. Engineer Staking. If section 824 of the Standard Specifications for Construction is not part of the contract and the Contractor's AMG operation requires a greater density of AMG control, the Engineer will provide AMG control that will be established with sufficient frequency and precision to adequately support the AMG operation being performed. Request AMG control from the Engineer at least 10 calendar days prior to the commencement of AMG operations. The Engineer will provide the AMG control information to the Contractor at least 2 calendar days prior to AMG operations.

6. Contractor Responsibility. The Contractor's AMG operation can only eliminate staking required for items as described in the approved AMG work plan. The Contractor is responsible for all quality control necessary for their AMG operations to meet the prescribed tolerances for each associated pay item. If prescribed tolerances are not met, the Contractor will either proceed with regular operations without the use of AMG or suspend operations to evaluate and address the AMG operations deficiencies. Once the cause of the inaccuracies is determined, the Contractor must provide the Engineer with a written corrective action plan addressing the concerns for the Engineer's approval. The Contractor may only resume AMG operations with the approval of the Engineer. If subsequent failures to meet specifications and accuracies are experienced, the Contractor will be suspended from AMG operations and conventional staking/operations must be provided at no additional cost to the contract.

Notify the Engineer at least 24 hours prior to commencement of AMG operations.

7. Quality Assurance. The Engineer will perform continuous and independent quality assurance for AMG operations to ensure compliance of the finished surfaces in accordance with the contract. The Engineer will use equipment and methods that adequately support the precision level of the verification. The Engineer is prohibited from using the Contractor's equipment in the quality assurance verification process. Acceptance of the results of AMG operations will be based upon quality assurance results falling within prescribed tolerances for each associated pay item. If the Engineer determines that the prescribed tolerances are not being met, the Contractor must suspend AMG operations.

d. Measurement and Payment. When the Engineer directs a change to the contract that requires a revision to the Contractor's model a work order will be generated that includes the number of hours agreed upon between the Engineer and the Contractor. Hours not documented on the work order will not be paid for by the Engineer unless approved otherwise.

The Department will pay for electronic model revisions using the following pay item:

Pay Item	Pay Unit
Electronic Model Revision	Hour

Electronic Model Revision includes compensation for revisions to the Contractor's model. **Electronic Model Revision** will be paid for at a fixed unit price of \$150.00 per hour.