## Section 152. — CONSTRUCTION SURVEY AND STAKING

01/06/23–FP14

WFL Specification 09/17/18 1520010

Include the following on all projects requiring work in this Section.

Description

### 152.01

Add the following:

WFL Specification 09/17/18 1520020

Consult the Construction Operations Engineer assigned to the project.

Include the following with earthwork projects that meet both of the following requirements:

 Are likely to use Automated Machine Guidance grading methods, and;

 It has been determined that Government owned surveying equipment will not be available.

The work also includes: providing, configuring, and maintaining Robotic Total Station (RTS) equipment, Global Positioning System (GPS) equipment, or both, for exclusive use by the CO when Automated Machine Guidance (AMG) methods are employed; and training the CO on the use of the provided equipment.

WFL Specification 09/17/18 1520030

Include the following on all projects requiring work in this Section.

Construction survey methods are defined as follows:

**(a) Automated Machine Guidance (AMG) method.** Grading equipment controlled with RTS technology, GPS technology, or a combination of the two.

**(b) Conventional survey methods.** All other survey methods.

WFL Specification 01/06/23 1520040

Include the following on all projects requiring work in this Section.

NOTE:

Consult the Construction Operations Engineer and WFL-Survey on projects that do not have controls or earthwork.

Edit and Outline the Subsections under Construction Requirements to make survey requirements project specific, and identify requirements by project segment or station if needed for clarity.

Construction Requirements

### 152.04 General.

Delete the text of this Subsection and substitute the following:

Conform to the following:

**(a) Personnel.** Provide a crew supervisor on the project whenever surveying and staking is in progress.

**(b) Equipment.** Furnish survey instruments and supporting equipment capable of achieving the specified tolerances.

Construction equipment controlled with AMG methods may be used in earthwork and the construction of subgrade; constructing subbase, base, and surface aggregate courses; or other construction operations when approved.

**(c) Material.** Furnish acceptable tools and supplies of the type and quality suitable for highway survey work. Furnish stakes and hubs of sufficient length to provide a solid set in the ground with sufficient surface area above ground for necessary legible and durable markings.

Include staking activities in the construction schedule submitted according to Section 155. Include the dates and sequence of each staking activity.

At the preconstruction conference, submit a cost breakdown of the work included in the lump sum item for the purpose of making progress payments.

WFL Specification 01/06/23 1520050

Include the following when the Government has set only control points.

**(d) Government set reference lines and points.** The Government has set horizontal and vertical control points for the project. The location and identity of each control point are shown on the plans.

Before beginning construction, notify the CO of any missing control points or stakes. The Government will reestablish control points and stakes missing before the beginning of construction.

WFL Specification 01/06/23 1520060

Include the following if the Government has set a stake only at the beginning of the project (such as for a station survey).

**(d)** **Government set reference lines and points.** The Government will set a stake to identify the beginning of the project. No other control will be furnished.

WFL Specification 01/06/23 1520080

Include the following in projects that meet both of the following requirements:

 Requires earthwork, and;

 The project was developed using 3D Design Software (Bentley Corridor Modeler, or Open Roads Designer).

Edit as needed to delete data that will not be provided. Do NOT edit to include additional data, or data in other formats without approval of Legal Counsel.

**(e) Government furnished information.** The Government will furnish the design data described below:

**(1)** Proposed horizontal alignment(s) and profile grade(s) in Portable Document Format (.pdf) and LandXML (.xml) formats;

**(2)** Cross Sections in Portable Document Format (.pdf);

**(3)** Earthwork end area volume report in Portable Document Format (.pdf);

**(4)** Superelevation report in Portable Document Format (.pdf) or Microsoft Excel (.xlsx) format;

**(5)** Clearing limits (based on theoretical catch points) in Portable Document Format (.pdf) or Microsoft Excel (.xlsx) format;

**(6)** Construction staking notes containing points at centerline, shoulders, and theoretical slope stake catch in Portable Document Format (.pdf) or Microsoft Excel (.xlsx) format;

**(7)** X, Y, Z coordinates of subgrade and base layer(s) points at centerline and shoulders, in Portable Document Format (.pdf) or Microsoft Excel (.xlsx) format;

**(8)** Proposed finished surface in LandXML (.xml) format;

**(9)** Proposed 3D breaklines in Drawing Exchange Format (.dxf);

**(10)** Existing ground surface in LandXML (.xml) format; and,

**(11)** Control Point coordinates in Microsoft Excel (.xlsx) format.

Perform additional conversions and calculations as necessary for convenient use of Government-furnished data. The Contractor is responsible for the accuracy of all information converted from the Government-furnished data. Provide immediate notification of apparent errors in the furnished data.

WFL Specification 01/06/23 1520090

Include the following on all projects requiring work in this Section. Outline the following as needed on projects that do not have controls or earthwork.

**(f) Pre-survey meeting.** Before surveying or staking, discuss and coordinate the following with the CO:

**(1)** Surveying and staking methods;

**(2)** Stake marking;

**(3)** Grade control for courses of material;

**(4)** Referencing;

**(5)** Structure control;

**(6)** Field staking data;

**(7)** Localization of the GPS systems to the Government-established control points; and

**(8)** Other procedures and controls necessary for the work.

Do not start work until staking or three-dimensional (3D) verification data for the affected work has been approved.

Preserve initial reference and control points. Notify the CO of missing control points or stakes at least 10 days before beginning construction. The Government will reestablish control points and stakes missing before the beginning of construction.

Acceptance of the construction staking does not relieve the Contractor of responsibility for correcting errors discovered during the work and for bearing additional costs associated with the error.

Maintain legibility of stake markings for the duration of the project or until notified in writing the stakes are no longer needed. Replace stakes if necessary to ensure markings are maintained.

Record survey and measurement field data in an approved format. Sample note formats are available as listed in Subsection 106.01. Submit as-staked data and corrections made to the Government-furnished survey data. Submit survey and measurement data at least weekly.

The construction survey and staking work may be spot-checked for accuracy, and unacceptable portions of work may be rejected. Resurvey rejected work, and correct work that is not within the tolerances specified in Table 152-1.

Remove and dispose of flagging, paint, lath, stakes, and other staking material after the project is complete.

Compute and furnish calculations supporting pay quantities. Measure quantities within the tolerances established by the CO according to Subsection 109.01.

WFL Specification 05/14/13 1520100

Include the following when roadway excavation work is paid for by ‘design’ quantity.

Do not use if:

• Roadway excavation is measured by Contract Quantity

• Confidence in roadway excavation quantity is low (i.e., limited survey)

Coordinate with 152.05(c) and 204.16(a)(1)(a)

Adjust roadway prism excavation quantities for volume changes resulting from slope stake variations. See Subsections 152.05(d) and 204.16(a)(1)(a).

WFL Specification 07/21/17 1520110

Insert the following when modifying this Subsection. Edit instructions as needed to match the modifications made.

### 152.05 Survey and Staking Requirements.

Amend as follows:

WFL Specification 09/17/18 1520120

Consult with the Construction Operations Engineer assigned to the project.

Include the following on earthwork projects that meet both of the following requirements:

 Are likely to use Automated Machine Guidance grading methods, and;

 It has been determined that Government owned surveying equipment will not be available.

Add the following after the first paragraph:

When AMG methods are used, provide for exclusive Government use, all surveying equipment (such as robotic total station, GPS, data collectors, and reflectors), software, and data files necessary for Government quality assurance inspection of the grading work. Provide equipment of the same make, model and version being used to construct the project. Provide equipment at least two-weeks before starting work that relies on the equipment. Continuously ensure that data provided to the Government is the same version being used to construct the project. Maintain all equipment in good working order and provide replacements to the CO within two working days when breakdowns occur. The CO will return all supplied equipment upon project completion.

Provide two separate 8-hour training sessions on the use of the contractor-provided surveying equipment. Provide the first training session within one week after delivering equipment to the site. Provide the second training session upon request of the CO. Provide training on the project site by a manufacturers’ representative or as approved by the CO.

WFL Specification 09/17/18 1520130

Include the following when roadway excavation work is paid for by ‘design’ quantity.

Do not use if:

• Roadway excavation is measured by Contract Quantity

• Confidence in roadway excavation quantity is low (i.e., limited survey)

Coordinate with 152.04 and 204.16(a)(1)(a)

Add the following to paragraph (c):

Do not take roadway cross-sections unless required for volume adjustments. See Subsections 152.05(d) and 204.16(a)(1)(a).

WFL Specification 11/05/15 1520140

Include the following in all projects when direct payment for survey work is required (if you have lump sum survey pay items.

Payment

### 152.08

Delete the second paragraph and substitute the following:

Payment for lump sum items will be prorated based on the submitted cost breakdown for the work completed under this Section.