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| Use on all projects. |

## Section 152. — CONSTRUCTION SURVEY AND STAKING

**Construction Requirements**

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| Use on projects when no survey data is available. |

**152.04 General.**  Add the following to the second paragraph:

No horizontal or vertical control information will be provided.

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| Use on projects when survey data is available. Revise as needed to match project-specific requirements |

* 1. **General.**  Add the following to the second paragraph:

The Government will establish basic survey control points for vertical and horizontal control of the project.

The Government will furnish the following:

**(1)** 3D coordinates and offset distance from centerline for subgrade and surface course finishing stakes at 50-foot (20-meter) intervals and miscellaneous intermediate stations.

**(2)** Slope stake data containing centerline grade and slope staking information at 50-foot (20-meter) station intervals and miscellaneous intermediate stations.

**(3)** Computer listings containing: horizontal alignment, vertical alignment, earthwork quantities, and staking details showing superelevation template data and slope information.

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| Use on all projects when a 3D model is generated. |

**152.04 General.**  Add the following to the second paragraph:

The Government will furnish the following:

**(1)** Horizontal and vertical alignment staking information.

**(2)** Digital terrain model of existing ground.

**(3)** Digital terrain model of proposed design

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| Use on all projects. |

Delete the last sentence of the fourth paragraph from the bottom of the subsection and substitute the following:

Reestablish missing control points and stakes before slope staking begins.

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| Include 152.05(b) on all projects where centerline is reestablished from control points. |

**152.05 Survey and Staking Requirements.**

**(b) Centerline establishment.** Add the following:

Reestablishment of centerline may be ordered by the CO and paid for under Section 623 for purposes other than to control the work.

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| Use 152.05(c) on projects where field fitting / re-design is anticpated due to limited survey data available during design. |

**(c) Original ground topographic verification.** Delete the second paragraph and substitute the following:

When existing ground topography is not provided generate cross-section data at slope stake locations between centerline and 10 feet (3 meters) beyond the actual point of intersection of the design slope with the natural ground line.

Add the following:

Submit ground topographic verification data to CO 21 days prior to anticipated construction. Do not begin embankment construction or excavation operations until the design profile has been verified. If differences in terrain are found, the CO may modify the profile to match the new terrain. Modified design data will be provided at locations where the design profile has been modified. Data consists of revised earthwork quantities, revised plan & profile sheets, cross-section sheets, and staking reports for modified locations, and an updated grading summary.

Submit one printed copy and one electronic file of the cross-sectional data in ASCII text format: station, offset, elevation, north coordinate, east coordinate, p-code text format. Include a file header that defines the data type of the column. (Contact the CO for more information on the format.) Include one observation per line in the submitted files showing the following data:

Station (nominal), offset from centerline, elevation, north coordinate, east coordinate, p-code (Feature code: RH for reference hub, CL for centerline).

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| Use on projects with grade finishing stakes. |

**(f) Grade-finishing stakes.** Delete paragraph (1) AMG method.

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| Use on all projects with culverts, including culvert extensions. |

**(g) Culverts.** Delete the text and substitute the following:

Verify and set culvert locations at the inlet, outlet, and inlet basin points according to the plans. Plot the centerline of the proposed culvert at a 1:20 scale. Show the natural ground, the flow line, the roadway section, and the culvert including end treatments and other appurtenances. Provide the elevations, grade, culvert length, degree of elbow, catch points, and hinge points on the plot.

Perform the following if the culvert design shown in the plans does not fit field conditions, when the CO requires adjustment to a culvert location, or when a culvert design isn’t provided for a new culvert, culvert replacement, or culvert extension:

**(1)** Recommend a revised culvert location and alignment if needed.

**(2)** Survey and record the ground profile along the culvert centerline;

**(3)** Determine the slope catch points at the inlet and outlet;

**(4)** Set reference points and record information necessary to determine culvert length and end treatments;

**(5)** Plot to scale the profile along the culvert centerline. Show the natural ground, the flow line, the roadway section, and the culvert including end treatments and other appurtenances. Show elevations, grade, culvert length, and degree of elbow.

*(a)* For single skewed culverts, submit a plotted field-design cross-section normal to roadway centerline and at each end section. Plot the offset and elevation of natural ground at the end section and at proposed template break points between centerline and the end section. Ensure the template design embankment slope is not exceeded;

*(b)* For multiple skewed culverts, submit a plotted field design cross-section normal to roadway centerline and at the end sections (left and right) nearest to the shoulder. Plot the offset and elevation of natural ground at the end section and at proposed template break points between centerline and the end section. Ensure the template design embankment slope is not exceeded;

*(c)* Submit the plotted field-design cross-section for approval of final culvert length and alignment. Plot at a clear and readable scale;

*(d)* Set inlet, outlet, and reference stakes when the field design has been approved. Stake inlet and outlet ditches to make sure the culvert and end treatments (such as drop inlets) are functional; and

*(e)* Adjust slope, reference, and clearing stakes as necessary to provide for culvert inlet treatments in cut slopes. Readjust slope, reference, and clearing stakes as necessary when culvert inlets are moved from their plan locations. Review slope adjustments with the CO and obtain approval.

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| Use 152.05(i) on all projects with retaining walls |

**(i) Retaining walls and reinforced soil slopes.** Delete the Subsection and substitute the following:

**(i) Retaining walls.** Survey and record profile measurements along the face of the proposed wall at 5 feet (1.5 meters), 10 feet (3 meters), and in front of the wall face. Take cross-sections every 25 feet (8 meters) along the length of the wall and at major breaks in terrain within the limits designated by the CO. Measure and record points every 25 feet (8 meters) and at major breaks in terrain for each cross-section. Set additional references and control points to perform the work.

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| Use centerline verification and staking on all 3R projects with no widening or cross-slope correction and where striping needs to be reestablished.  For reestablishing the original design cross-slope or making corrections, use “template control staking” |

Add the following:

**(m) Centerline verification and staking.** Verify stationing shown in the plans by measuring along the existing centerline with a method approved by the CO. Calibrate all measuring devices and furnish calibration data to CO before use. Use landmarks (e.g., culverts, turnouts, approach roads) to verify that the ground stationing matches the stationing shown on the plans. Use white spray paint to mark each centerline station. Add station equations to adjust field stationing to match the plans. Notify the CO on any readjustment or change to stationing or establishment of additional centerline points.

Measure the existing surface width at 200 foot (60 meters) stationing intervals on tangent and at 50 foot (15 meter) intervals on curves. At each location, each side of the roadway and outside the construction limits, place an offset stake of adequate dimensions to place all required information. Label each stake with the following information corresponding to each respective lane:

**(1)** Station

**(2)** Offset from striped centerline or other location as directed by the CO

**(3)** Offset from the proposed edge of pavement

Measure stations to the nearest foot (meter), offsets to the nearest 2 inches (50 millimeters). Record the above information and provide to the CO.

Use this recorded information to control the proposed roadway width and reestablish striping.

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| Include the following paragraphs **only** when 3R work includes template corrections. |

Add the following:

**(n) Template control staking.** Verify stationing shown in the plans by measuring along the existing centerline with a method approved by the CO. Calibrate all measuring devices and furnish calibration data to CO before use. Use landmarks (e.g., culverts, turnouts, approach roads) to verify that the ground stationing matches the stationing shown on the plans. Use white spray paint to mark each centerline station. Add station equations to adjust field stationing to match the plans. Notify the CO on any readjustment or change to stationing or establishment of additional centerline points.

Prior to disturbing the existing road surface measure the existing roadway surface width and cross-slopes at centerline points of curve and tangent, at changes in roadway template, at the beginning and ending of superelevation transitions and runoff, in the middle of superelevated sections, at 100 foot (30 meter) stationing intervals on tangents, and at 50 foot (15 meter) intervals on curves. At each location, each side of the roadway and outside the construction limits, place an offset stake of adequate dimensions to place all required information. Label each stake with the following information corresponding to each respective lane:

**(1)** Station;

**(2)** Offset from striped centerline or other location;

**(3)** Offset from the proposed edge of pavement;

**(4)** Existing pavement cross-slope. If cross-slope is to be changed, provide proposed change;

**(5)** Offset to existing/proposed paved ditch, including ditch cross-slope, if different from mainline, and ditch width; and

**(6)** Offset to face of existing/proposed guardrail.

Record the above information and provide to the CO. Provide the CO a list of any stations or locations where the proposed pavement edge is within 2 feet (0.6 meters) of a break in the topography of the shoulder. The CO will determine if corrective action is required.

Measure stations to the nearest foot (meter), offsets to the nearest 2 inches (50 millimeters), and cross-slopes to the nearest 0.2 percent. Record the above information and provide one printed copy to the CO.

Make minor adjustments in alignment to produce a smooth flowing, best-fit alignment. The final alignment need not be a geometrically computed centerline and may be field adjusted up to 12 inches (300 millimeters).

Use the recorded information to reestablish the existing roadway template and striping. Control crown and superelevation on the project. Proposed cross-slope information shown in the plans is typical and grading adjustments may be altered as necessary to fit field conditions.

On tangents compute the appropriate grade adjustment from the measured elevation differences between centerline and proposed edge of pavement. Determine the elevation adjustment so both lanes are within the desired limits of minus 1 to minus 3 percent crown. The crown on each lane of the roadway may be different. Set a grade finishing stake on centerline to control crown.

On curves compute the appropriate grade adjustment from the measured elevation differences to obtain a consistent cross-slope along the curve length (typically an average of the measured cross-slopes) within a tolerance of ±0.5 percent. Where possible raise the elevation of a shoulder to make the adjustment. Only lower the elevation of a shoulder when approved by the CO. Set a grade finishing stake on either shoulder (typically the shoulder point to be raised) to control the cross-slope. Use the existing superelevation runoff and tangent runout lengths to transition between the crown on tangents and superelevation on curves.

The methodology used to accomplish the existing roadway surface measurement, template control staking, and to determine template adjustments shall be the Contractor’s option, but the methods will be subject to the approval of the CO.

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| Use on all pavement preservation projects. |

Add the following:

**(n) Pavement preservation roadway width verification.** Prior to placement of aggregate roadway surface, measure the existing pavement surface width at 500 foot (150 meters) stationing intervals on tangent, and at 100 foot (30 meters) intervals on curves. Use white spray paint to mark the pavement with the station of measurement on each side of the roadway. Take additional measurements between the above required intervals if the width varies more than one foot from the plan pavement surface with. Provide a record of width measurements and corresponding station locations to the CO for approval prior to beginning surfacing operations. Make additional measurements, at no additional cost to the Government, when requested by the CO. The revised approved surface widths will become the new surfacing width unless otherwise directed by the CO.

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| Note: Do not include a 152 bid item for Miscellaneous survey and staking. Include pay items/hours for Hired survey and staking and also Hired technical services so the CO can request additional work. Include hours for Hired survey and staking and Hired technical services under the bid items 62302-1000 Special Labor, Hired technical services and 62302-1100 Special Labor, Hired survey services. |

**Measurement**

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| Use on all projects. |

**152.07** Delete the third paragraph and substitute the following:

Do not measure miscellaneous survey and staking.

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| Use on all projects with government-established control points. |

**152.07** Add the following to the fourth paragraph:

Reestablishing missing control points and stakes will be measured under Special labor, Hired survey services when it is paid by the hour.

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| Use on all 3R projects with centerline verification and staking item. |

**152.07** Add the following:

Measure centerline verification and staking only one time per project.

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| Use on all 3R projects with template control staking item. |

**152.07** Add the following:

Measure template control staking only one time per project.