

SECTION 650 CONSTRUCTION STAKING

650.1 Description

- (1) This section describes the contractor performed construction staking required under individual contract bid items to establish the horizontal and vertical position for the following:

Storm sewer systems	Subgrade	Base
Curb, gutter, and curb & gutter	Pipe culverts	Structure layout
Concrete pavement	Concrete barrier	Resurfacing reference
Electrical installations	Initial layout	

650.2 (Vacant)

650.3 Construction

650.3.1 General

- (1) Department and contractor responsibilities for construction staking are specified in 105.6. Conform to 105.6 and the additional requirements specified here in 650.3 for the individual contractor-staking bid items the contract includes.
- (2) Protect and preserve known property and survey marks and land monuments as specified in 107.11.3. The contract may require related work under the section 621 bid items.
- (3) Obtain or calculate benchmark data, grades, and alignment from plan information. The engineer will furnish data for the horizontal and vertical control points, control point ties, horizontal alignments, profiles, and elevations. Reestablish, set additional, and maintain the horizontal and vertical control points and control point ties, as needed for bid items. Furnish, set, reference, and maintain all stakes and markings necessary to establish the alignment, location, benchmarks, elevations, and continuous profile-grades for all road and structure work as needed for bid items. Supervise and coordinate construction staking.
- (4) Check horizontal and vertical information including but not limited to alignments, locations, elevations, and dimensions, that either the plans show or the engineer provides, for compatibility with existing field conditions. Conduct similar compatibility checks and accuracy checks of horizontal and vertical positions either the department or the contractor establishes in the field.
- (5) Perform survey work using global positioning or conventional methods. Establish additional benchmarks and control points as necessary to support the method of operation, or as the engineer directs. Do not use global positioning methods to establish the following:
1. Structure layout horizontal or vertical locations.
 2. Concrete pavement vertical locations.
 3. Curb, gutter, and curb & gutter vertical locations.
 4. Concrete barrier vertical locations.
- (6) Maintain neat, orderly, and complete survey notes, drawings, and computations used in establishing the lines and grades. Make the survey notes and computations available to the engineer within 24 hours, upon request, as the work progresses.
- (7) Furnish all surveying equipment, stakes, flags, pins, lath, whiskers, and other materials necessary to perform this work, subject to the engineer's approval.

650.3.2 Storm Sewer System

- (1) Set and maintain construction stakes or marks as necessary to achieve the required accuracy and to support the method of operations. Locate all pipe, inlet, catch basin, manhole, and endwall construction stakes to within 0.02 feet horizontally and establish the elevations to within 0.01 feet (3 mm) vertically. Determine that the final elevations of storm sewer pipe outfalls and inlets match the existing field elevations, and provide this information to the engineer at a mutually agreed upon date or least 14 calendar days before ordering inlets, catch basins, manholes, endwalls, and storm sewer pipe.

650.3.3 Subgrade

- (1) Set construction stakes or marks at intervals of 100 feet, or more frequently, for rural sections and at intervals of 50 feet, or more frequently, for urban sections. Include additional stakes at each cross-section as necessary to match the plan cross-section, achieve the required accuracy, and to support construction operations. Also set and maintain stakes as necessary to establish the horizontal and vertical positions of

intersecting road radii, auxiliary lanes, horizontal and vertical curves, and curve transitions. Locate stakes to within 0.25 feet (75 mm) horizontally and establish the grade elevation to within 0.03 feet (10 mm) vertically.

650.3.4 Base

- (1) Set construction stakes or marks at 100-foot (40 m) intervals for rural sections and 50-foot (20 m) intervals for urban sections. Set and maintain sufficient stakes at each cross section to match plan cross-section, achieve the required accuracy, and to support the method of operations. Set and maintain stakes as necessary to establish horizontal and vertical position along intersecting road radii, auxiliary lanes, vertical and horizontal curves, and curve transitions. Locate stakes within 0.25 feet (75 mm) horizontally and establish the grade elevation to within 0.03 feet (10 mm) vertically.

650.3.5 Curb, Gutter, and Curb & Gutter

- (1) Set construction stakes or marks at 50-foot (20 m) intervals, maximum. Set and maintain stakes as necessary to achieve the required accuracy and to support the method of operations. Set additional construction stakes as necessary to establish location and grade of curb, gutter, and curb & gutter, including points of change in alignment grade, along intersecting radii, and at the radius points of intersecting road radii. Locate stakes to within 0.02 feet (7 mm) horizontally and establish the grade elevation to within 0.01 feet (3 mm) vertically.

650.3.6 Pipe Culverts

- (1) Set and maintain construction stakes or marks as necessary to achieve the required accuracy and to support the method of operations. Locate stakes for pipe culverts and appurtenant inlets and catch basins to within 0.25 feet (75 mm) horizontally and establish the grade elevation to within 0.03 feet (10 mm) vertically. If installing pipe culverts at existing drainage ditches, verify the existing ditch location, elevations, and skew for a minimum of 150 feet (60 m) from pipe ends, and provide this information to the engineer at a mutually agreed upon date or 14 calendar days before ordering pipe culverts.

650.3.7 Structure Layout

- (1) Set construction stakes or marks on a line offset from the structure centerline or on a reference line, whichever is appropriate, for both roadway and substructure units. Establish the plan horizontal and vertical positions to the required accuracy. Also, set and maintain stakes and marks as necessary to support the method of operations. Locate stakes and marks to within 0.02 feet (7 mm) of the true horizontal position, and establish the grade elevation to within 0.01 feet (3 mm) of true vertical position. The department, unless the contract specifies otherwise, will compute deck grades with contractor-supplied girder elevation data.

650.3.8 Concrete Pavement

- (1) Set construction stakes or marks at 25-foot (8m) intervals. Set and maintain additional stakes as necessary to establish location and grade along intersecting road radii; and for auxiliary lanes, vertical curves, horizontal curves, and curve transitions according to the plans. Locate stakes to within 0.02 feet (7 mm) horizontally and establish elevations to within 0.01 feet (3 mm) vertically. Set and maintain sufficient additional stakes at each cross-section to achieve the required accuracy and to support the method of operations.

650.3.9 Concrete Barrier

- (1) Set construction stakes or marks at 50-foot (20 m) intervals, maximum. Set and maintain additional stakes as necessary to establish location and grade of concrete barrier including point of change in grade, along intersecting radii, and at the radius point of intersecting radii to achieve the required accuracy and to support the method of operations. Locate stakes to within 0.02 feet (7 mm) horizontally and establish the grade elevation to within 0.01 feet (3 mm) vertically.

650.3.10 Resurfacing Reference

- (1) Set construction stakes for pulverized and re-laid pavement before beginning milling operations. Place construction stakes or pins for offsetting the roadway reference line at 100-foot (40 m) intervals, minimum, or as the engineer directs.
- (2) Place construction stakes or marks for all other types of resurfacing work at 300-foot (120 m) intervals, minimum, or as the engineer directs.
- (3) Set and maintain additional stakes as necessary to establish location and grade along intersecting road radii, auxiliary lanes, and curve transitions according to the plans.

650.3.11 Electrical Installations

- (1) Set and maintain construction stakes or marks as necessary to achieve the required accuracy and to support the method of operations. Locate stakes to within 0.02 feet (7 mm) horizontally and to establish the grade elevation to within 0.01 feet (3 mm) vertically.

650.3.12 Supplemental Control

- (1) Set and maintain construction marks as required to support the method of operations consistent with third-order, class I horizontal and third-order vertical accuracy. Check the department provided horizontal and vertical control information and notify the engineer of any discrepancies. Provide marks to establish and maintain intermediate vertical and horizontal control for reference line alignment, side road alignments, radius points, bench level circuits, and offsetting the horizontal roadway alignment. These marks constitute the field control used to govern and execute the work.
- (2) Document and provide to the engineer complete descriptions and reference ties of the control points, alignment points, and benchmarks to allow for quick reestablishment of the plan data at any time during construction and upon project completion. Document additional control on forms described as a part of the contractor staking packet in CMM 3-1-10.

650.3.13 Slope Stakes

- (1) Verify the existing ground elevations as shown for all roadways on cross-section sheets for accuracy. Take and document a minimum of 5 shots per roadway section, one at the centerline or at an engineer-approved offset from the centerline and 2 at each side of the roadway. For the shots at the roadway sides, take one shot at the slope stake and one shot at the slope intercept. If the elevation at the slope intercept is off by more than 0.4 foot (120 mm), notify the engineer.
- (2) Set and maintain slope stakes on each side of the road at each cross-section location the plans show. Locate stakes to within 0.25 feet (75 mm) horizontally and establish elevations to within 0.1 feet (30 mm) vertically.

650.4 Measurement

- (1) The department will measure the Construction Staking bid items for subgrade, base, concrete pavement, resurfacing reference, and slope stakes by the linear foot acceptably completed, measured along each roadway centerline. The department will not measure construction staking for base underlying concrete pavement.
- (2) The department will measure Construction Staking Curb Gutter and Curb & Gutter by the linear foot acceptably completed, measured along the base of the curb face. The department will measure Construction Staking Concrete Barrier by the linear foot acceptably completed, measured along the base of the barrier. The department will not measure these bid items if abutting concrete pavement.
- (3) The department will measure Construction Staking Storm Sewer System as each individual inlet catch basin, manhole, and endwall acceptably completed.
- (4) The department will measure Construction Staking Pipe Culverts by each individual pipe culvert staked and acceptably completed.
- (5) The department will measure Construction Staking Structure Layout as a single lump sum unit for each structure acceptably completed. The department will measure Construction Staking Electrical Installations as a single lump sum unit for all electrical installations acceptably completed on each project. The department will measure Construction Staking Supplemental Control as a single lump sum unit for all control marks acceptably completed on each contract.

650.5 Payment

- (1) The department will pay for measured quantities at the contract unit price under the following bid items:

<u>ITEM NUMBER</u>	<u>DESCRIPTION</u>	<u>UNIT</u>
650.4000	Construction Staking Storm Sewer System	EACH
650.4500	Construction Staking Subgrade	LF
650.5000	Construction Staking Base	LF
650.5500	Construction Staking Curb Gutter and Curb & Gutter	LF
650.6000	Construction Staking Pipe Culverts	EACH
650.6500	Construction Staking Structure Layout (structure)	LS

650.7000	Construction Staking Concrete Pavement	LF
650.7500	Construction Staking Concrete Barrier	LF
650.8000	Construction Staking Resurfacing Reference	LF
650.8500	Construction Staking Electrical Installations (project)	LS
650.9910	Construction Staking Supplemental Control (contract)	LS
650.9920	Construction Staking Slope Stakes	LF

- (2) The department will not make final payment for any staking item until the contractor submits all survey notes and computations used to establish the required lines and grades to the engineer within 21 days of completing this work. The department will deduct from payments due the contractor for the additional costs specified in 105.6.
- (3) Payment for all the Construction Staking bid items is full compensation for locating and setting all construction stakes; for relocating and resetting damaged or missing construction stakes.
- (4) Payment for Construction Staking Initial Layout also includes resetting damaged or missing preliminary construction stakes; for protecting and reestablishing the alignment of all roadways; and for setting and checking slope stakes for all roadways.
- (5) Payment for Construction Staking Storm Sewer System also includes setting construction stakes as necessary for storm sewer pipe associated with each inlet, catch basin, manhole or endwall staked.
- (6) Payment for Construction Staking Pipe Culverts also includes setting construction stakes for appurtenant inlets and catch basins as necessary associated with each pipe culvert staked.