

SPECIAL PROVISION

NOTE: This special provision is generally written in the imperative mood. The subject, "the Contractor" is implied. Also implied in this language are "shall", "shall be", or similar words and phrases. The word "will" generally pertains to decisions or actions of Sedgwick County Public Works.

CONTRACTOR CONSTRUCTION STAKING

1. DESCRIPTION

Provide land surveying and construction surveying services and set right-of-way according to the Contract Documents and consistent with standard surveying practices.

<u>BID ITEM</u>	<u>UNITS</u>
Contractor Construction Staking	Lump Sum

2. MATERIALS

- a. **General.** Provide the necessary materials to complete the specified surveying services. Provide materials and equipment that comply with the current requirements of the Kansas Statutes, Kansas State Board of Technical Profession's Regulations and the Contract Documents.
- b. **Benchmark Discs.** Provide standard 2 inch diameter, domed, metal (either brass or bronze) survey monuments to be set in concrete structures.
- c. **Acceptance of Materials.** The Engineer will accept materials for the specified surveying services, other specified requirements and visual inspection for condition.

3. CONSTRUCTION REQUIREMENTS

a. General.

- (1) With the Engineer's approval, the Contractor's surveying operations may begin after the contract is signed, but prior to issuing the Notice to Proceed.
- (2) Surveying Personnel. Before performing any surveying operations on the project, inform the Engineer of the Contractor's personnel responsible for land surveying, construction surveying and staking. Provide a Land Surveyor, trained and experienced in the construction staking and licensed by the Kansas State Board of Technical Professions according to Kansas Statutes to perform the required land surveys, the setting of all section corners, right-of-way survey monuments and reference point monuments set on the right-of way lines.
- (3) Provide surveying equipment that complies with the following tolerances:

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- Slope Staking: Horizontal and Vertical tolerance of ± 0.10 feet (per KDOT Construction Manual -Cross Sections 3.06.02). Use a GPS system, a Total Station, or a Level & Transit.
 - Finish Staking: (grade hubs, string lines etc.) and Structures: Horizontal = ± 0.05 feet; Vertical = ± 0.01 feet (per KDOT Construction Manual - Finishing Stakes 3.09.01 and 3.09.02). For Horizontal, use a GPS system or a Total Station. For Vertical, use a Level.
 - Critical Bridge Member Staking: Horizontal = ± 0.02 feet; Vertical = ± 0.01 feet (Vertical as per KDOT Construction Manual - Finishing Stakes 3.09.01 and 3.09.02). For Horizontal, use a GPS system or a Total Station. For Vertical, use a Level. See **subsection 3.c.(2)** for Critical Bridge Member Staking.
 - Project Control Points: The relative precision of any project control point ± 0.05 feet from the project coordinate data. Use a GPS system or Total Station.
 - Field Notes: For all land surveying and construction staking, record 2 measurements for verification in the field notes for all PLSS corners and all project control points.
 - GPS equipment: Take 2 GPS measurements at a minimum interval of 2 hours with the base station at 1 or 2 project control points. Include in the field survey notebooks a copy of the site calibration. The site calibration includes an area extending a minimum of 200 feet beyond the beginning and ending of the project and the construction limits furthest offset to the left and right of the project centerline. Take a minimum of 4 calibration points or as directed by the Engineer. Use the sum of the maximum residual of the site calibration and the delta of the point being staked. When using Continuously Operating Reference Stations located in Sedgwick County take a minimum of two multiple readings on project control points using two separate satellite configurations.
 - Total Stations: To verify the tolerances, record total station measurements from 2 project control points (foresight or backsight) to the point being established. Use the average of the 2 resulting coordinate values for the point being staked for the specified tolerances.
 - Levels: Record in the field notes a turn through each project benchmark as they are encountered during staking activities (per KDOT Construction Manual - Elevations 3.23.05).
- (4) Before proceeding with the field surveys, provide the Engineer with a written report of any errors or apparent discrepancies found in previous surveys or the Contract Documents. The Engineer will provide the corrections or necessary interpretations.
- Correct any deficient engineering layout or construction work that is the result of inaccuracies in the Contractor's surveys or staking operations, or the failure to report inaccuracies found in the work previously done by Sedgwick County, at no additional cost to Sedgwick County.
- (5) The Engineer will perform final checks, measurements and surveys involving the determination of any pay quantities. The Engineer may check the accuracy and control

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of the Contractor's construction staking at any time throughout the duration of the project.

b. Land Surveying.

- (1) Before any construction activity starts in the immediate area of an endangered Public Land Survey System (PLSS) corner, recover all endangered section corners and accessories of the PLSS on the project. Endangered PLSS corners are those as defined by Kansas Statutes and/or shown in the Contract Documents as lying within the range from the project centerline to a distance 100 feet outside the construction limits, throughout the length of the project. Establish a minimum of 3 reference ties for each endangered PLSS corner. Each reference tie shall be a direct measurement to a precise (hard defined) point. Specify slope or horizontal measurement.

Complete a Land Survey Reference Report marked as a "Notice of Endangerment Activity" for each endangered PLSS corner. File the reports with the appropriate governmental custodian responsible for maintaining those records, as required by Kansas Statutes. Provide the Engineer with copies of the completed reports.

- (2) Before any construction activity starts in the immediate area, clearly establish the right-of-way as shown in the Contract Documents. If the R/W Survey Monuments are set initially, determine each monument's position with the project coordinates, project stationing and offset. Provide the Engineer with a written report of each monument's position for each R/W Survey Monument set supplementary to those shown in the Contract Documents including additional monuments, monuments requested by the Engineer and monuments offset near obstructions.
- (3) Recover and verify, or reset all of the PLSS corners previously reported as endangered PLSS corners. Verify the top of all PLSS corners monuments are $\frac{1}{4}$ to $\frac{1}{2}$ inch below the finish grade on concrete pavement and 4 to 6 inches below the finish grade on asphalt pavement. Establish a minimum of 3 reference ties for each of the PLSS corners. Each reference tie shall be a direct measurement to a precise (hard defined) point. Specify slope or horizontal measurement.

Complete a Land Survey Reference Report marked as a Notice of Completion of Endangerment Activity and Report of Restoration for each restored PLSS corner previously reported as endangered. File the reports with the appropriate governmental custodian responsible for maintaining those records, as required by Kansas Statutes. Provide the Engineer with copies of the completed reports.

- (4) Before the completion of project construction, set all of the R/W Survey Monuments shown in the Contract Documents. If the R/W Survey Monuments were set initially, visually inspect each R/W Survey Monument to determine if it was either disturbed or destroyed. Reset all of the R/W Survey Monuments that are determined as disturbed or destroyed, at no cost to KDOT. Determine each reset monument's position with both the project coordinates and the project stationing and offset. Provide the Engineer with a written report of all right-of-way survey monuments set.

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c. Construction Surveying and Staking.

(1) General.

- Check alignment and reference or re-reference all necessary control points.
- Establish or re-establish project centerline.
- Run a level circuit to check or re-establish plan benchmarks; set other benchmarks as needed.
- Take original cross-sections that are not incorporated in the plans.
- Stake or re-stake right-of-way where needed. (to be done by a Licensed Professional Land Surveyor).
- Perform all construction layout and reference staking necessary for the proper control and satisfactory completion of all structures, grading, paving, drainage and all other appurtenances required for the completion of the work and acceptance of the project.
- Construction of ditches and other planned excavation and embankment designated in the Contract Documents may be performed by Global Positioning System (GPS) controlled grading equipment, according to the Contract Documents and this specification. GPS controlled grading equipment does not eliminate the need for finish staking or blue top staking. Once a week, provide the Engineer with documentation (on a preapproved form) verifying machine calibration to monitor, verify, adjust and compensate for the wearing surface of the cutting edge of the machine being utilized.

(a) GPS Equipment. Use GPS controlled grading equipment capable of meeting the end results specified in the Contract Documents. The Engineer may require verification of shot locations. This could be by witnessing the Contractor take shots with GPS Rover, etc.

(b) Electronic Design Files/GPS Model. When available, County will provide Electronic Design Files for the project. Convert the files provided by County into the format required by the Contractor's system and equipment. Conform to the typical sections. Notify the Construction Engineer and Project Engineer, in writing, of any errors, omissions, ambiguities, or perceived inadequacies found in the Electronic Design Files provided by County.

Make no claim on the contract under **SECTION 104**, for additional money, additional time or both because the County produced plans differ from drawings generated from the Electronic Design Files, even if the Contractor did not manipulate the Electronic Design Files before generating the GPS Model. Accept sole responsibility for the adequacy and accuracy of all Contractor-generated, subcontractor-generated, or supplier-generated documents or GPS Models used on the project. Assume the risk of errors and omissions resulting from software conversions, Electronic Design File

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manipulation or other Electronic Design File creation used by the Contractor, subcontractors, suppliers or any combination thereof.

The GPS Model the Contractor generates from the Electronic Design Files may differ from the Contract Documents. The Contractor assumes the risk of such discrepancies.

KDOT printed plans controls over the related Electronic Design File(s) which controls over the Contractor's GPS Model.

(c) When requested, provide the Project Engineer with an electronic copy of the GPS 3D Model created for that use. In addition to the GPS machine control, provide centerline stakes, slope stakes and grade stakes from the beginning thru the end of the project, at 500-foot intervals on straight runs, and at 250-foot intervals on curves, transitions, intersections, interchanges and break points. The Engineer may require closer staking intervals for other locations, such as transition areas. GPS controlled machine grading does not eliminate the need for finish staking or blue top staking.

The Engineer may review the Contractor's GPS machine control grading results, surveying calculations, records, field procedures and actual staking at any time. If the Engineer determines the work is not meeting the required horizontal and vertical tolerances, see Unacceptable Work, **SECTION 105**.

Contractor delays or errors due to operating the GPS machine control system will not result in any adjustment under **SECTION 104**, for additional money, additional time or both.

- (2) Bridge. Prior to construction, set project control points and Critical Bridge Element control points for the horizontal and vertical location of the Critical Bridge Element features under the supervision of a Licensed Professional Land Surveyor. Critical Bridge Elements include, but are not limited to the features listed in **TABLE 1**.

Prior to construction, provide an independent survey performed under the supervision of a different Licensed Professional Land Surveyor to check the accuracy of the original survey of project control points and locations of the Critical Bridge Elements features.

Report any differences or discrepancies to the Project Engineer.

Resolve any differences or discrepancies, prior to construction of the Critical Bridge Elements.

After the Critical Bridge Elements have been constructed, provide a survey under the supervision of a Licensed Professional Land Surveyor to verify the locations and elevations of the Critical Bridge Elements.

All surveys shall be within the tolerances for that bridge element allowed in the Contract Documents.

Report any discrepancies in excess of the tolerances to the Project Engineer.

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TABLE 1: CRITICAL BRIDGE ELEMENTS	
Critical Element	Critical Component(s)
Spread Footing	Location & Elevation of CL
Pile Cap Footing	Location & Elevation of CL
Drilled Shaft	Location & Elevation of Center
Drilled Shaft	Location & Elevation of CL
Column	Location & Elevation of Center
Pile Bent with Web Wall	Location & Elevation of CL
Abutment Beam/Bearing Seat	Location & Elevation of CL
Pier Beam/Bearing Seat	Location & Elevation of CL
Bearing Devices	Location & Elevation of CL, Temp. Offset
Bearing Stiffener	Location & Elevation of CL, Temp. Offset
Girder/Beam Location of CL	Location of CL
Anchor Bolts/Preformed Holes	Location of CL
Expansion Device	Gap (Corrected for Temp) and Alignment
Fillets (Tenth Points)	Elevation
Surface of Forms (Slab Bridge Tenth Points)	Elevation
Post-tensioning Duct	Location & Elevation
Bolted Field Splice	Elevation

(3) **Documentation.** Provide and maintain a current copy of all field survey notebooks at the project site at all times. Produce the original field survey notebooks for inspection upon request by the Engineer. Include a detailed list of any abbreviations, codes, formatting or other nomenclature contained in the notebooks to facilitate clarity of the notes. Provide either one or a combination of both of the following types of notes, as directed by the Engineer:

- Provide standard, bound field notebooks where the handwritten field notes are indexed and kept in a clear, orderly and neat manner consistent with standard surveying practices.
- Provide a legible ASCII file for electronic field notes where the “theoretical (calculated) point” can be checked against the “established point” set in the field. This method allows for a check of the inverse distance and direction for error tolerance. This procedure should be utilized for points with elevations. Before any construction staking begins, the procedures for all electronic field notes must be approved by the Engineer.

(4) **Monuments.** Upon completion of the surfacing, recover and verify or reset all of the field survey monuments (such as P.I.’s, P.O.T.’s, P.C.’s, P.T.’s, P.O.S.T.’s,) on the project

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centerlines or baselines, as shown in the Contract Documents. Verify that the top of the field survey monuments are set a maximum of ½ inch below the finish grade on concrete pavement, or a maximum of 6 inches below the finish grade on asphalt pavement. Verify the accuracy of the locations of all field survey monuments versus those of the project centerlines or baselines shown in the Contract Documents. Establish a minimum of 4 reference ties for each of the field survey monuments on the project centerlines or baselines.

- (5) Reports. Provide a written report to the Engineer indicating the descriptions of all field survey monuments and their 4 reference ties, regardless if the information in the Contract Documents was revised or not. Include in the report “station calls” for each of the field survey monuments (such as P.I.’s, P.O.T.’s, P.C.’s, P.T.’s, P.O.S.T.’s) on the project centerlines or baselines shown in the Contract Documents. Recover and verify all of the project benchmarks shown in the Contract Documents. Establish permanent replacement benchmarks for all project benchmarks that were destroyed during the construction using one of these methods:

- A benchmark disc “set in place” on new concrete structure.
- A benchmark disc “drilled and grouted” on existing concrete structure.
- A benchmark disc set in the top of a concrete footing (6-inch diameter x 4-foot depth into the ground, minimum) cast in place.
- A benchmark type consistent with standard land surveying practices.

Provide the Engineer with a written report of all post project benchmarks, listing the benchmark number, elevation, project stationing and offset, and a complete description of the monument type and its physical location. Include in the report, all of the remaining benchmarks shown in the Contract Documents, the permanent replacement benchmarks and the remaining additional “construction benchmarks” used for the staking of the project. Do not include in the report any “temporary benchmarks” used for the construction staking of the project that are classified as “temporary” or “degradable” in nature.

- d. **As-Built Construction Plans and Survey Notebooks.** Upon completion of the project, provide the Engineer with a set of as-built construction plans with the following information:

- The monument descriptions and the 3 reference ties for all restored PLSS corners.
- The monument descriptions and the 4 reference ties for all field survey monuments on the project centerline or baseline.
- The permanent replacement benchmarks and remaining construction benchmarks with benchmark number, project station and offset, elevation and description. Deliver the original field survey notebooks to the Engineer upon completion of the project.

4. MEASUREMENT AND PAYMENT

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Contractor construction staking will be measured by the lump sum.

The Engineer will make partial payments according to **TABLE 2**. The Engineer may adjust the **TABLE 2**, based on Contractor’s progress and project complexity.

TABLE 2: CONSTRUCTION STAKING PAYMENT SCHEDULE*	
Percent of Original Contract Amount Completed	Percent of Bid Item Paid
Work Started	25%
5%	40%
25%	60%
50%	80%
70%	95%
All field books, As-Built construction plans (subsection 3d.) and records have been submitted to the Engineer.	100%

*Until all appropriate information is received, and the bid item is 100% paid, the work is considered incomplete and subject to **SECTION 108**.

The Percent of Original Contract Amount Completed = the amount earned by the Contractor divided by the total dollar value of the original contract (all bid items).

Payment for "Contractor Construction Staking" at the contract prices is full compensation for the specified work.

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