

SECTION 201

CONSTRUCTION STAKES, LINES AND GRADES (CONTRACTOR FURNISHED STAKING)

201.1 DESCRIPTION

- A. General:** This work shall consist of furnishing and placing construction stakes necessary to construct the project. The staking work includes establishing project centerline; re-establishing plan and Rapid City Network control points; setting additional benchmarks and control points as needed; measuring volumes of necessary topsoil stockpiles; topographic surveys for final cross sections earthwork quantities; verifying undercut, muck, rock and dig-out removal quantities; staking right-of-way (ROW), easements, and project limits; and other miscellaneous construction survey work.

The surveyor performing work under this section shall either be licensed or shall be under the direct supervision of a Registered Land Surveyor. Surveyor shall perform all construction layout and reference staking necessary for accurate control and completion of all structure construction, grading, paving, drainage, fence, permanent control points, ROW monuments and all other appurtenances required for the complete construction and acceptance of the work. The layout shall include, but not be limited to, staking clearing line; removal limits; slope staking and slope stake referencing; grade staking (blue top dirt grade and base course grade hubs); paving hub staking; staking of water mains, fittings, hydrants and valves; staking of sewer mains, bends, manholes, and services; staking of culvert pipes and structures; re-establishing property corners; and performing the miscellaneous staking as described in the plans and in these specifications.

Horizontal and vertical control shown on plans shall be referenced to at least two City network control points.

Upon request the Engineer may allow construction staking to proceed at the contractors risk prior to actual construction operations. Such conditional approval shall not be considered the start of the project day count. The Contractor shall not begin actual work on the project until a complete Notice to Proceed is received, at which point the project day count will begin.

B. Related Work:

Section 8A	Water
Section 9	Sanitary Sewer
Section 11	Utility Excavation and Backfill
Section 54	Drainage Pipe Installation
Section 62	Drop Inlets
Section 63	Storm Sewer Junction Boxes and Manholes

201.2 MATERIALS

- A. The Contractor shall furnish all materials of adequate quality for the purpose intended, including all stakes, stake chasers, paint, field note books, and all other materials necessary to properly perform the required work.
- B. Stakes shall be suitable for general field construction staking and shall be durable enough to last the duration of the project without undue weathering so as to make the stake illegible or difficult to read or use. Stakes that become illegible shall be remarked or reset at the Contractor's expense.
- C. Paint, when used in lieu of plastic flagging to mark survey stakes, shall be brightly colored or fluorescent pink to be visible from passing equipment. Paint that becomes faded shall be remarked or reset at the Contractor's expense.
- D. Plastic flagging shall be brightly colored or fluorescent pink plastic ribbon securely tied to the survey stake. Plastic flagging that becomes faded, torn or dislodged shall be replaced at the Contractor's expense.
- E. Property pins/markers shall meet current South Dakota requirements for legal property monuments.
- F. Field note books shall be made of quality, heavy, water resistant paper and may be bound with a permanent binding or may be in loose leaf binding. Notes shall be made with a waterproof pen or pencil.

201.3 CONSTRUCTION REQUIREMENTS

- A. **General:** A South Dakota Registered Land Surveyor will be required to re-establish property corners per South Dakota Law. The Contractor shall submit the name and registration number of the land surveyor who will perform the corner and monument relocation work on the project. A record of survey on how the corner was re-established shall be submitted to the Engineer upon completion of the work.

All other work shall be done by or under the supervision of a South Dakota Licensed Land Surveyor or a South Dakota Professional Engineer who is experienced and competent in urban street and road construction surveying and staking. The Land Surveyor or Professional Engineer shall be available to review work, resolve problems and make decisions in a timely manner. A crew chief, who is competent to perform all required surveying duties and who is under the direct supervision of the surveyor or engineer, shall be onsite to supervise and/or perform the staking in the absence of the surveyor or engineer on the project.

The Contractor shall also submit a proposed starting date of the staking and the anticipated surveying work schedule, and these dates must be consistent with the anticipated construction work schedule.

The Contractor, through the Contractor's surveyor or engineer, shall be responsible for the accuracy of the staking. All errors and discrepancies found on previous surveys, plans, or specifications shall be called to the attention of the Engineer prior to proceeding with further survey and construction work.

The overall supervision of the construction staking personnel shall be the responsibility of the Contractor. Any deficient survey layout or staking performed by the Contractor's surveyor or engineer, or any unreported errors in previous surveys that may result in construction errors, shall be corrected by the Contractor at no additional cost to the City.

Field notes shall be kept in conventional, handwritten note books or in a computerized form acceptable to the Engineer. Notes shall be kept in a clear, orderly and neat manner, with all pertinent information duly noted therein. The field notes shall be made available for inspection and review by the Engineer at any time during or after the project.

If required, final cross sections (terrain data), where required, shall be submitted to the Engineer in an electronic file compatible with City survey and computer equipment. The Contractor shall convert the terrain data, as necessary, to suitable format compatibility at no additional expense to the City prior to submittal. When required by plans and specifications, printed cross sections showing original sections and as-constructed data shall be submitted to the Engineer upon completion of the project.

If the Contractor encounters a property pin, benchmark, or ROW marker not identified in the plans, they shall immediately notify the Engineer.

Stakes which are damaged, destroyed or made unusable during construction shall be replaced by the Contractor at no additional expense to the City.

The Engineer may check the accuracy and control of the Contractor's survey work at any time. The checks performed by the Engineer will not relieve the Contractor of the responsibility for the accuracy of the survey layout or the construction work.

The level circuit to check the plan benchmarks shall be run the full length of the project.

- B. Slope Staking:** Shall be set at the catch points. The slope stake reference hubs shall be offset behind the slope stake a sufficient, set, consistent distance to prevent disturbance during construction.

Slope stakes shall be clearly referenced and shall be set at intervals consistent with the plan stationing. Horizontal curves and vertical curves will require additional slope stakes set at intervals sufficient to maintain adequate grade and line control. Intervals shall be maximum 100 feet in tangent sections and maximum 50 feet in curve sections. The Engineer has authority to increase the staking interval. Slope stake tolerances shall be ± 0.2 feet horizontal and ± 0.1 feet vertical. Slope stake reference hubs shall reference the subgrade shoulder and tolerances will be ± 0.2 feet horizontal and ± 0.05 feet vertical.

The Contractor shall retain the slope stakes and hub references until the grading work is completed and accepted by the Engineer.

- C. Grade Staking:** The grade finishing stakes (blue tops) for grade elevations and horizontal alignment shall be set on the roadway crown/centerline and at the top of the subgrade at the outer limits of base course, where there is no existing curb and gutter. Where curb and gutter shall remain, only crown/centerline stakes are required. Blue tops are required for finished subgrade and finished base course grade. Contractor may request alternative methods to blue topping outer limits of the basecourse. If curb and gutter stakes are utilized for a reference, they must be placed within three (3) days of base course placement.

Transverse distance between blue tops shall not exceed 20 feet. Intermediate blue tops will be required and shall be approved by the Engineer when transverse distance exceeds this value.

The blue top grade stakes shall be set at station intervals consistent with the plans not to exceed 50 feet on tangents and horizontal and 25 feet vertical curves. The horizontal tolerance is ± 0.2 feet and the vertical tolerance is ± 0.02 feet.

The subgrade shall be finished to within minus 0.08 feet to plus 0.02 feet from the design grade and typical section shown in the plans and to within $\pm 0.5\%$ of the typical section cross slope. The quarter crown within any 12 foot transverse length shall not exceed 0.04 feet above or below a straight edge, string line, or by other suitable equipment measuring between the crown and edge of roadway. The centerline shall be finished to a transverse distance within ± 0.25 feet of the plans shown location of centerline.

The Contractor shall furnish stakes of sufficient length to provide a solid set in the ground. Half-length lathe stakes or stake chasers shall be placed adjacent to or on the blue top hubs for guards. Stakes not meeting these requirements shall be reset at no additional expense to the City.

The Contractor shall retain the outer-most roadway blue tops and guards through placement of the gravel base course material.

For asphalt paving the contractor is required to set grade stakes at the top of the gravel base course material, the blue tops shall remain in place until the gravel base course material is finish graded and accepted by the Engineer.

Paving hubs for portland cement concrete paving shall be set at each transverse joint. Closer spacing which may be required by the paving contractor will be at no additional expense to the City. Horizontal and vertical tolerance is ± 0.02 feet.

Grading, blue tops, and paving hub notes will become the property of the City.

- D. Machine Control Grading (MCG):** The contractor may elect to use grading equipment with an automated machine control system for MCG provided the equipment and methods used provide the same results in the finished work as conventional construction staking. Equipment shall be properly calibrated and shall be referenced daily to established benchmarks. Records of daily calibration shall be provided to the Engineer. The contractor shall have an appropriate number of calibration points on the perimeter of the project. The calibration points shall be verified by the Engineer. The Engineer may require the Contractor to revert to conventional staking methods for all or part of the work at any point during construction if, in the Engineer's opinion, the MCG produces unacceptable results. There shall be no assumption that the necessary digital files will be available for any project, unless specifically stated in the detailed plans and specifications. Even when MCG is utilized, a minimum amount of staking is still required.
- E. Re-establish Property and ROW Markers:** Contractor shall immediately notify the Engineer if any property corner is disturbed or if he anticipates disturbing a property corner. All property corners, ROW markers, or other monuments shall be properly replaced by a licensed land surveyor. Known property corners and ROW markers shall be shown on the plans.
- F. Rapid City Network Control Points:** All Rapid City control network monuments within the project limits shall be shown on the plans and any Rapid City control networks points destroyed or damaged shall be replaced under the supervision of a Registered Land Surveyor to the satisfaction of the City Land Surveyor. The Contractor shall notify the Engineer if they encounter a control network monument that is not shown on the plans.

Installation procedures for Rapid City Network Control Points shall be approved solely by the City Land Surveyor.

G. Miscellaneous Staking:

1. Final earthwork (or terrain data) cross sections at the same intervals, stations and plus stations as the original cross sections when required by plans and detailed specifications;
2. Approach road/driveway staking;
3. Topsoil stockpile measurement;
4. Ditch/drainage staking;
5. Staking and/or measurement of sub-excavation, muck excavation, rock excavation, undercut excavation and dig-outs;
6. Staking of signs, pavement markings, guardrail, curb and gutter, light poles, conduit, junction boxes and irrigation systems, and related items;

7. Water and sanitary sewer mains and services including pipe, manholes, valves, bends, fittings, hydrants, appurtenances and related items;
8. Mark limits of removal items (trees, foundations, curb and gutter, sidewalk, etc.);
9. Storm pipe culvert and storm sewer staking including drop inlets, manholes and related items. Set reference stakes for the storm sewer inlet and outlet locations. Stake ditches and inlet and outlet grades to ensure proper drainage.

The horizontal tolerance for water and sanitary sewer main and storm sewer staking is ± 0.05 feet and the vertical tolerance is ± 0.03 feet. When sanitary sewer is being installed at minimum grade, project specific tolerances may be required by the Engineer.

201.4 METHOD OF MEASUREMENT

- A. **Staking:** Shall be lump sum when shown as lump sum in the proposal.
- B. **Remove and Reset Property Pins:** Shall be per each when shown in the proposal.

201.5 BASIS OF PAYMENT

- A. **Staking:** Shall be paid at the lump sum unit price established in the bid proposal where such work is proposed as a lump sum item. Partial payment of lump sum unit price, when allowed, shall be made according to the following schedule:

Percentage of Contract Amount Completed (Excluding Construction Staking Itself)	Percentage of Construction Staking Paid
Five Percent (5%)	Twenty-Five Percent (25%)
Twenty Percent (20%)	Fifty Percent (50%)
Thirty-Five Percent (35%)	Sixty Percent (60%)
Fifty Percent (50%)	Seventy Percent (70%)
Seventy-Five Percent (75%)	Ninety Percent (90%)
Project Completion	One Hundred Percent (100%)

- B. **Remove and Reset Property Pins:** Will be paid at the per each unit price established in the bid proposal where such work is proposed as a per each item.

END OF SECTION