

**SECTION 801**  
**CONSTRUCTION STAKES, LINES AND GRADE**

**801-1 DESCRIPTION**

When required by the contract, provide all construction layout, surveying, stakeout, supplemental surveying and engineering necessary for the proper control of construction operations in accordance with this section and the *Manual for Construction Layout*. Provide a stakeout of areas where an environmental permit is required before performing any construction in or adjacent to these areas. Stake out limits of the permitted work areas according to the approved permit drawings. Provide clear delineation by use of highly visible flagging. Insure construction limits do not exceed approved permitted work areas. Immediately notify the Engineer of any variations of the stakeout limits when compared to the approved permit drawings.

The *Manual for Construction Layout* and the *Guidelines for Drainage Studies and Hydraulic Design* may be obtained from the Contract Standards and Development Unit.

**801-2 CONSTRUCTION METHODS**

**(A) General**

Furnish personnel who are under the direct supervision of the Contractor's project engineer or a land surveyor licensed by the State of North Carolina in conformance with NCGS § 89C.

Furnish personnel who are experienced in highway construction surveying and are capable of accurately establishing all line and grade points necessary to complete the work in accordance with the plan dimensions within the precision established in the *Manual for Construction Layout*. Consult the Engineer for clarifications of the plans.

Perform work in safe manner and conform to Article 107-21. Perform all flagging operations in accordance with Section 1150.

The Contractor may elect to use global positioning system (GPS) surveying, either static or kinematic. Perform GPS surveys with same or higher order of accuracy as conventional surveys detailed in the *Manual for Construction Layout*. Department projects use a localized coordinate system developed by the Location and Surveys Unit specifically for each individual project. Obtain the control information that the Location and Surveys Unit used in establishing the localized coordinate system, specifically the rotation, scaling, translation and coordinates for the azimuth pairs. Newly developed GPS procedures and techniques that do not conform to this section may be used, if approved.

Investigate the plan horizontal alignment, vertical profile and super elevation of existing facilities that tie to proposed roadways. Investigate 100 feet beyond all paving limits and revise grades as needed to establish smooth transitions to the existing facilities.

Tie existing driveways to proposed facilities within the limits detailed in the plans and within the gradients detailed in the *Roadway Standard Drawings*.

The Engineer reserves the right to check, correct where necessary or require any layout work to be revised. The Engineer will perform checks to ensure the roadway, structure and incidental items are surveyed in accordance with the plans and the *Manual for Construction Layout*.

The Department's review of the Contractor's work in no way relieves the Contractor of responsibility for conformance with the contract. Failure by the Engineer or inspector to point out unsatisfactory work, from lack of discovery or for any other reason, in no way prevents later rejection or corrections to the unsatisfactory work, when discovered. No

1 claims will be allowed for losses suffered due to any necessary removals or repairs  
2 resulting from the unsatisfactory work.

3 When requested by the Engineer, check the accuracy of the stakeout. Correct all  
4 inaccuracies in the construction stakeout before performing the affected work.

5 When the Contractor proposes an alteration to the plans to rectify a construction stakeout  
6 error, submit alterations to the Engineer for review and approval. Include design  
7 calculations and drawings sealed by an engineer licensed by the State of North Carolina  
8 along with a narrative describing justification for the alteration.

9 When surveying is required, which in the Contractor's opinion could not have been  
10 reasonably anticipated and is not customary or inherent to the construction industry,  
11 notify the Engineer in writing before beginning such surveying. After investigation, the  
12 following will occur:

13 (1) When the Engineer determines that the surveying could not have been anticipated or  
14 is not customary or inherent to the construction industry, the Contractor will be  
15 notified in writing that the work is considered supplemental and measurement and  
16 payment will be made in accordance with Article 801-3.

17 (2) When the Engineer determines that the surveying could have been anticipated or is  
18 customary or inherent to the construction industry, he will notify the Contractor, in  
19 writing, of his determination. If the Contractor intends to file a claim for additional  
20 compensation by reason of such surveying, notify the Engineer in writing of such  
21 intent before beginning any of the alleged supplemental surveying. Strictly adhere to  
22 Subarticle 104-8(B).

### 23 **(B) Records**

24 Submit proposed method for setting up survey books or electronic data files to the  
25 Engineer before beginning work to assure clarity and adequacy.

26 Promptly make available to the Engineer all requested survey records.

27 Provide updates to the Engineer monthly of the electronic and/or manuscript survey  
28 records. Submit remaining records upon completion of the work. Attest the work was  
29 performed in accordance with the contract by providing all receivable information signed  
30 by an engineer or land surveyor licensed by the State of North Carolina and in  
31 responsible charge.

### 32 **(C) Horizontal and Vertical Control**

33 The Department will provide azimuth pairs to be used as primary horizontal and vertical  
34 control at approximately 1 mile intervals along the project corridor, and secondary  
35 horizontal baseline control on approximate 1,000 foot intervals and secondary vertical  
36 control on approximate 2,500 foot intervals within the project limits. Obtain a copy of the  
37 electronic survey control files from the Engineer.

38 Clearing limits may be established during original traverse of baseline control provided  
39 the accuracy ratio does not exceed 1 foot per 5,000 feet of perimeter and all Department  
40 established baseline control is protected and preserved during clearing operations. Before  
41 performing any additional construction layout, verify the horizontal baseline control by  
42 a closed traverse survey or alternate approved method based on the established azimuth  
43 pairs. The horizontal accuracy ratio shall not exceed an error of closure of 1 foot per  
44 20,000 feet of perimeter. Verify the vertical control by performing a closed loop survey  
45 using differential leveling. For the vertical error of closure, do not exceed 0.05 feet times  
46 the square root of the miles:

47 
$$\text{Error of Closure} \leq 0.05 \text{ ft} \sqrt{(x) \text{ miles}} .$$

## Section 801

1 Notify the Engineer of any discrepancies in either the horizontal or vertical control.  
2 Reference, outside of the proposed construction limits and evenly distributed throughout  
3 the project limits, a minimum of 50% of the Department's horizontal and vertical control.  
4 Provide reference information to the Engineer.

5 If GPS is used, occupy the azimuth pairs with the base station during verification of  
6 baseline control, otherwise, occupy baseline. Verify remaining baseline control using a  
7 Rover. Submit coordinate data showing differences between supplied baseline  
8 coordinates and field obtained GPS coordinates. Include report detailing the use of  
9 preliminary input data, specifically rotation, scaling and translation.

10 Using the horizontal and vertical control established by the Department, provide  
11 surveying necessary to construct all roadway, structure and miscellaneous items as  
12 detailed in the plans. Perform staking in accordance with the *Manual for Construction*  
13 *Layout*. Layout the work and provide all measurements that may be required for the  
14 execution of the construction in conformity with the contract.

### 15 (D) Right of Way, Control of Access and Easements

16 The Department will establish the location of all proposed right-of-way markers, control-  
17 of-access markers and permanent easements. Validate the position of the markers and  
18 permanent easement locations with those detailed in the plans. Report any discrepancies  
19 to the Engineer.

20 Reference the location of all proposed markers and permanent easements. Restore right-  
21 of-way and control-of-access monument positions after completion of construction. Set  
22 a right-of-way or control-of-access monument cap on an 18 inch (minimum) long  
23 #5 reinforcing bar and a carsonite witness stake unless concrete right-of-way and control-  
24 of-access markers are specified in the contract. The Department will provide the  
25 monument cap and witness stake. Re-establish location of permanent easements after  
26 completion of construction and install a permanent easement cap on 18 inch (minimum)  
27 long #5 reinforcing bar for monumentation.

28 Re-establishment and verification of existing monuments or the replacement of existing  
29 monuments with other material (concrete R/W markers, new iron pins, etc.), shall be  
30 performed under the responsible charge of a North Carolina Professional Land Surveyor  
31 (PLS). Verify all right of way, permanent easement, and control-of-access monument  
32 positions after completion of construction with signed and sealed attestation by PLS of  
33 said verification in accordance with the *Manual for Construction Layout*.

### 34 (E) Cross sections for Earthwork Quantities

35 The Engineer may elect to obtain cross sections either by hand or aerial methods. If the  
36 Engineer elects to obtain cross sections by aerial methods, furnish materials and install  
37 photogrammetric control panels in accordance with the *Manual for Construction Layout*  
38 or as otherwise directed.

#### 39 (1) Borrow Pits

40 Establish a baseline alignment or establish horizontal and vertical control on  
41 approximate 1,000 foot intervals within each borrow pit, as necessary, to allow the  
42 Engineer to obtain measurement of quantities for payment. Stake these alignments  
43 just before field cross sections are taken by the Engineer for original, intermediate  
44 and final cross sections.

#### 45 (2) Roadway

46 Unless otherwise directed, stakeout the survey lines for original and final cross  
47 sections. The stakeout of the survey lines will consist of surveying and staking all  
48 alignments within the plans on 50 foot intervals, including all cardinal points. When  
49 the alignments are inaccessible, install offset alignments. Begin the staking of these

1 alignments within 48 hours of the Engineer's notice to proceed. Upon the  
2 completion of the entire project, with the exception of the survey line for final cross  
3 sections, and upon request by the Contractor, the project may be accepted for  
4 maintenance by the Department, excluding the survey line.

## 5 (F) Drainage and Utility Construction Systems

### 6 (1) General

7 Where underground conflicts are suspected, contact utility owners and locate all  
8 utilities horizontally and vertically. Consider the utilities' locations and elevations in  
9 the layout of the drainage systems and utility construction systems. Utilities may  
10 exist that are not depicted in the plans.

11 Submit two copies of all layout drawings for drainage systems and utility  
12 construction systems to the Engineer for his review and approval. The Engineer will  
13 note the review and approval by adding an appropriate note to the drawings along  
14 with the date and his signature. The Engineer will retain a copy of the drawings and  
15 a copy will be returned to the Contractor.

### 16 (2) Drainage Systems

17 Provide construction layout of drainage systems, as depicted in the plans and in  
18 accordance with the *Guidelines for Drainage Studies and Hydraulic Design*.  
19 Consider the locations and elevations of all existing and proposed utilities, proposed  
20 utility construction and existing and proposed drainage systems, in the layout of the  
21 drainage system. Modifications of the drainage plan may be necessary to properly  
22 collect and transport water. Advise the Engineer if modifications are needed to  
23 achieve the original design functionality and the intent of the drainage plans, such as  
24 adjusting the location of a drainage structure, adding a drainage structure and  
25 increasing or decreasing pipe lengths. The Engineer will review any major  
26 modifications.

27 Provide layout drawing of the drainage system including calculations of flow line  
28 elevations for all drainage structures; pipe invert elevations, both inlet and outlet of  
29 the drainage structure; grade of each pipe within the drainage system; elevation of  
30 any existing facility connection, such as stream or pipe; headwall location, if  
31 depicted in the plans; and locations and elevations of any existing or proposed  
32 utilities to the Engineer for review and approval at least 7 days before beginning  
33 work on the drainage system. Modification of the submitted drainage layout drawing  
34 by the Engineer will not eliminate the Contractor's liability for the accuracy of the  
35 information submitted. Any restaking or additional staking required to conform to  
36 the approved drainage layout drawing is incidental to the work.

### 37 (3) Utility Construction

38 Provide utility construction layout as detailed in the contract. Consider the locations  
39 and elevations of all existing and proposed utilities, proposed utility construction and  
40 existing and proposed drainage systems in the layout of the utility construction.  
41 Advise the Engineer if modifications to the utility construction plans are necessary.  
42 The Engineer will review any major modifications.

43 Provide layout drawing of the utility construction system including elevations of any  
44 existing utilities, drainage systems and/or proposed drainage systems to the Engineer  
45 for review and approval at least 7 days before beginning work on the utility  
46 construction system. Modification of the submitted utility construction layout  
47 drawing by the Engineer will not eliminate the Contractor's liability for the accuracy  
48 of the information submitted. Any restaking or additional staking required to  
49 conform to the approved utility layout drawing is incidental to the work.

## Section 801

### 1 (G) Structures

2 Provide surveying and calculations necessary to construct structures in accordance with  
3 the plans. Provide staking in accordance with the *Manual for Construction Layout*.  
4 Establish horizontal alignment of entire structure. Set at least one benchmark adjacent to  
5 the structure site that will be retained throughout the structure construction. The  
6 Engineer will furnish the finished construction elevations for use in determining the  
7 required construction elevations for bridges. Provide method for computing buildups  
8 over beams, screed grades and overhang form elevations to the Engineer for review  
9 before staking these items to assure clarity and adequacy.

10 Submit two copies of structure layout drawings to the Engineer for his review and  
11 approval. The Engineer will independently verify and accept the structure layout before  
12 the structure construction may begin. The Engineer will note the review and approval by  
13 adding an appropriate note to the drawings along with the date and his signature. The  
14 Engineer will retain a copy of the drawings and a copy will be returned to the Contractor.

15 If structure phasing or damaged stakes require significant resurveying during the life of  
16 the structure, provide revised layout drawing for the Engineer's verification and  
17 acceptance.

### 18 (H) Signs

19 Stake horizontal locations of all overhead and Type A and B ground-mounted signs for  
20 Engineer's verification before obtaining S-dimensions. Measure or calculate overhead  
21 and ground-mounted sign S-dimensions in accordance with the plans and the *Manual for*  
22 *Construction Layout*. Perform investigation of proposed sign locations and notify the  
23 Engineer of any obstructions, either existing or proposed, that may interfere with the  
24 proposed sign installation. Provide an 11 inch x 17 inch drawing depicting the theoretical  
25 finished section at each proposed overhead sign assembly location. Include within the  
26 submittal the roadway, shoulder and slope gradients. Include the proposed finish  
27 elevations of the edges of pavement, each lane line and the ground at each proposed sign  
28 footing location. Set a slope stake at each proposed overhead sign location to ensure the  
29 slopes are constructed as calculated and detailed in the above submittal. Submit sign  
30 information to the Engineer. Stake horizontal locations of all ground mounted and barrier  
31 mounted signs.

### 32 801-3 MEASUREMENT AND PAYMENT

33 *Construction Surveying* will be paid at the contract lump sum price for the work detailed in  
34 this section.

35 Partial payments will be made on each particular payment estimate based upon the percentage  
36 complete of *Construction Surveying* as determined by the Engineer. The Contractor shall  
37 submit a certified statement each month indicating the percentage of *Construction Surveying*  
38 work completed. The Engineer will determine if the amount indicated is reasonably correct  
39 and the Engineer will pay accordingly on the next partial pay estimate.

40 Establishment of baseline alignments within each borrow pit is incidental to *Construction*  
41 *Surveying*.

42 *Supplemental Field Surveying* will be measured and paid as the actual number of hours the  
43 Contractor's survey crew is actively engaged in performing the following:

44 (A) Investigative surveying, in excess of 100 feet of horizontal alignment, vertical profile and  
45 superelevation of existing facilities that tie to proposed roadways.

46 (B) Surveying specifically for the relocation of utility conflicts.

47 (C) Investigation of a previous stakeout when such stakeout is found to be correct.

- 1 (D) Surveying that the Engineer has deemed could not have been anticipated or is not
- 2 customary or inherent to the construction industry.
- 3 (E) The stakeout of the roadway survey alignments for intermediate cross sections when
- 4 deemed necessary by the Engineer.
- 5 If the Engineer determines intermediate cross sections are not necessary for computing partial
- 6 payments, the intermediate stakeout of the survey line is incidental to the work.
- 7 *Supplemental Surveying Office Calculations* will be measured and paid as the actual number
- 8 of hours the Contractor’s survey personnel is actively engaged in performing office
- 9 calculations specifically associated with Subarticles 801-3(A) through 801-3(E).
- 10 *Supplemental Surveying Office Calculations* will be paid at the stated price of \$60.00 per
- 11 hour. *Supplemental Field Surveying* will be paid at the stated price of \$110.00 per hour. The
- 12 payment includes furnishing personnel, all surveying equipment, stakes, layout drawings,
- 13 calculations, stakeout records and any materials and equipment necessary to perform the
- 14 surveying and engineering work.
- 15 If the Engineer directs that the accuracy of the original stakeout be checked and the stakeout
- 16 is found to be in error, perform the work required to check and correct the stakeout at no cost
- 17 to the Department.
- 18 *Exploratory Excavation* required to locate a utility will be paid in accordance with
- 19 Article 104-7.
- 20 *Work Zone Signs (Portable)* will be paid in accordance with Article 1110-4.
- 21 *Flaggers* will be paid by the day in accordance with Article 1150-4.
- 22 Any payments for *Supplemental Field Surveying* or *Supplemental Surveying Office*
- 23 *Calculations* required by this section will be paid on the appropriate partial payment estimate.
- 24 Payment will be made under:

<b>Pay Item</b>	<b>Pay Unit</b>
Construction Surveying	Lump Sum
Supplemental Field Surveying	Hour
Supplemental Surveying Office Calculations	Hour

**SECTION 802  
DISPOSAL OF WASTE AND DEBRIS**

**802-1 DESCRIPTION**

The work consists of the disposal of waste and debris including, but not limited to, furnishing any waste areas; providing and implementing a Development, Use and Reclamation Plan; any right of access to waste areas; disposing of waste and debris; dressing and shaping of waste areas; furnishing and spreading earth material over debris, rock, broken pavement and masonry; clearing and grubbing of waste areas; hauling waste and debris to waste areas or permitted landfills; assessment for wetlands and endangered species; obtaining required permits or certifications; and any tipping fees required for disposal in permitted landfills.

Define “waste” as all excavated materials that are not used in the construction of the project, including overburden from borrow sources and soil-type base course sources.

Define “debris” as all undesirable material encountered on the project.

**802-2 GENERAL REQUIREMENTS**

Follow the most recent reclamation procedures found on the Department’s website for all waste sites. Before the removal of any waste from any project, obtain certification from the State Historic Preservation Officer of the State Department of Cultural Resources certifying