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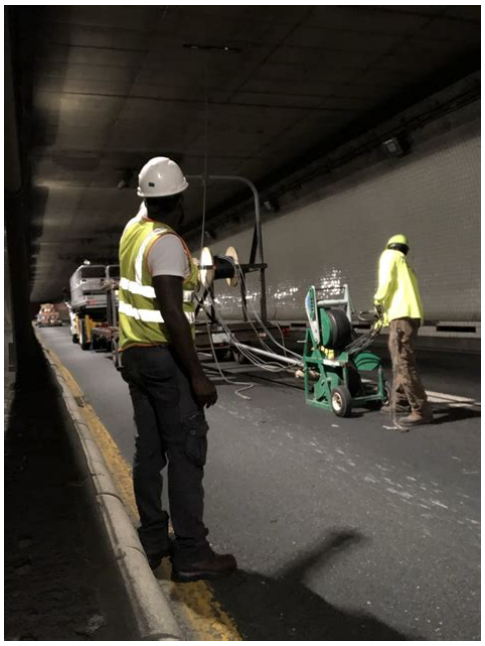

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This provision states Available substructure information should also be consulted. Wall envelope verification should take place well before construction is planned to start. This provision states “Temporary shoring is required to maintain traffic when a 21 HV slope from the top of an embankment or bottom of an excavation will intersect the existing ground line less than 5 ft from the edge of pavement of an open travelway.” Ensure that the drainage system is properly installed and functioning. Use of aerial surveys for this purpose may allow a Resident Engineer to better utilize available manpower. The decision to utilize the Photogrammetry Unit to provide this service should be based on several factors, which are listed below. In general, the safety of NCDOT employees, the quantity of earthwork involved, and extent of acreage under construction must be of sufficient volume to make this type of operation economical. It is important that all required erosion control measures be installed in conjunction with clearing and grubbing. As a rule, the smaller the site the more economical it is for ground surveys and the larger the site the more economical it is for aerial surveys. If Photogrammetry is chosen as the most economical or practical method, the All communication between the Contractor and the The Contractor may be required to clear and grub more than the Projects can and should, if feasible, be flown in stages. The Contractor must simultaneously install all measures required by the plans for the clearing and grubbing phase and have the necessary equipment available to maintain these devices over a relatively large area. The Contractor should be advised that the opening of larger areas to accommodate photogrammetric methods would not affect the areas allowed for grading operations. In some instances, the Photogrammetry Unit will not always be able to fly a project before a Contractor is ready to begin

his grading operations.http://classiccharters.com/pages/98-saturn-sl2-manual-transmission.xml

The original terrain data representing these areas must then be forwarded to the Photogrammetry Unit prior to or concurrent with the ground control surveys so they can be combined with the aerial survey terrain data for incorporation into the total earthwork computations for the project. This length should normally be The decision on length of project to be flown should be mutually determined by the Resident Engineer and the Photogrammetry Unit. These panels should be set according to the panel plan provided by Photogrammetry. Questions concerning placement of panels may also be directed to the Photogrammetry Unit. Weather and schedule permitting, the photo mission will be flown immediately upon completion of the paneling operation. The aerial photography is normally processed the same day the mission is flown. The Photogrammetry Unit notifies the Resident Engineer the next workday if the photography has been accomplished. Upon request, a copy of the printout and a graphic plot can be provided. In order to provide a check of the original terrain data determined by the Photogrammetry Unit, the Resident Engineer should collect some terrain data points as slope stakes are set. These terrain data points should be furnished to the Photogrammetry Unit with the slope stake data. The Digital Terrain Model from the Photogrammetry Unit should be checked to ensure that coverage is carried out far enough. Any corrections or extensions that are needed should be identified and furnished to the Photogrammetry Unit.The Resident Engineer must furnish a copy of all plan changes that affect horizontal or vertical limits as originally shown in the plans as this may impact the original terrain data. Panels will also have to be set by the Resident Engineer’s office prior to the flight. The Photogrammetry Unit requires a minimum of Weather and schedule permitting, the photo mission will be flown immediately upon completion of the paneling operation.

Before the final terrain data and excavation quantities can be determined, the Resident Engineer must furnish the Photogrammetry Unit electronic copies of the final ground controls, slope stake data, and available project profile levels of the final profile along each line. Template information accounting for the subgrade earthwork will be taken from the plans. After the final terrain data has been determined, the Photogrammetry Unit may compute the unclassified earthwork estimate. After the unclassified earthwork estimate has been computed, it will be furnished to the Resident Engineer. The Resident Engineer’s office should provide a check of the final terrain data by collecting some terrain data points in the field and comparing them to the Photogrammetry Unit’s terrain data. Any corrections or extensions that are needed should be identified and furnished to the Photogrammetry Unit.Control panels enable the A survey party is required to install control panels prior to the aerial photography. The Resident Engineer’s survey party normally installs all of the control panels. If the Resident Engineer needs assistance in installing the panels, the Ground control surveys Photogrammetry will need the following information for their flight Project and TIP Numbers The panel plan will be supplied to the Resident Engineer. Panels should be placed according to the supplied panel plan. If a panels needs to be moved from the designated location, notify and coordinate with the Photogrammetry Unit for the new locations. Regardless of what is used, there needs to be sufficient contrast between the panel and the background material. This information is located in the Plan Sheets. If there is any question concerning the control monuments, the Location and Surveys Unit should be contacted. All panels should be fully controlled x, y, and z. The Photogrammetry Unit will provide a panel plan for the pit. Control for the panels should be based off the localized NCGRID.

Once the Photogrammetry Unit has been notified in writing and the scope of the required photogrammetry work is clear, the acquisition of photography and unclassified earthwork estimation can begin. The preparation of the panel plan for the project can take up to a month to prepare. Placing the panels at the prescribed locations is important to properly control the project area. To schedule a flight, the Photogrammetry Unit should be notified The Photogrammetry Unit coordinates

with the Aviation Branch to fly the project. The flight over the project area is dependent on adequate weather conditions. Occasionally it will be necessary to field inspect the control panels to ensure their condition when there have been weather delays. When the Photogrammetry Unit receives the control, the collection of terrain data will begin, in the form of a Digital Terrain Model DTM. The process of developing a DTM will be repeated for all subsequent flights, either for original ground, intermediate quantities partial earthwork estimate, or for final earthwork estimate. Volume calculations are based off comparisons between the original DTMs and the final DTMs. Due to time constraints, this process should take place early in the project stages as soon as the project stake out information is available. The project phasing should be reviewed and discussed with the Contractor so that any signs that will need to be erected during early phases of the work are reviewed first. Slope stake data as determined by the Resident Engineers staff should be used in lieu of waiting for grading to be complete. When the project stake out is completed by the Contractor, the Resident Engineer should encourage this to be completed early and check the information for accuracy before requesting a plan revision. The dimensions listed on the plans must be checked against the actual field conditions and any corrected distances provided to Traffic Engineering so that they may issue revised plan sheets.

Form sheets for this will be provided by Traffic Engineering upon request. It should be noted that the distances below the point of reference on the drawings are positive and the distances above are negative. The following procedures should be used for verification of “S” dimensions The Resident Engineer or Contractor depending on who is responsible for project stake out should review the overhead sign drawings as shown in the original plans for accuracy. These drawings shall then be compared against the project typical sections as well as against the project roadway plans including cross sections. Adjustments in the location of these signs may be necessary to avoid these obstacles. Any relocation of these signs by any appreciable amount should be done only with consultation of the Project Signing Engineer. The actual section will be determined using proper lane and shoulder widths taking into account any tapers existing at these locations, roadway superelevations, shoulder rollovers, side ditches, barrier rail sections, etc. It is essential that the Contractor build the slopes in accordance with these slope stakes. Any changes in these side slopes need to be noted and corrections sent to the Signing Unit along with the completed verified “S” dimensions. Once this information is received by Traffic Engineering, and the revisions are complete, the revised plans will be forwarded to the Resident Engineer for his use and further distribution to the Contractor. The Resident Engineer should verify any changes that were made during the field verification are properly reflected. The Contractor may then proceed with the design of the overhead structures. Any plan revisions must be taken into account when these dimensions are verified. Also remember to revise these “S” dimensions as necessary if plan revisions come out after the field verification process is complete. The edge of the travel lane is not the outside edge of the paved shoulder.

When determining the “S” dimension, note if the elevation is above the travel lane or below the travel lane. If a sign is relocated in the field, note the new station and “S” dimensions so that the plans can be changed. See the following drawing titled The “S” dimension for overheads is different from that of ground mounted signs. The elevation of the center of the upright is from the high point of the road. This includes paved shoulders, mountable medians, future lanes, or any point that a vehicle could physically drive on under any sign on the overhead structure. The side slope is the slope at the centerline of the uprights and at least Both the “S” dimension and the slopes are used by Structure Design to check the footing design. The width of each lane or part of a lane, shoulders, and the offset to the uprights should be verified. This is the cross section that the contractor will have to construct. See attached drawing on the proceeding page for clarification. For projects that

have contract surveying, the Contractor will be responsible for providing this information to the Resident Engineer in accordance with The Resident Engineer will forward the information to the Verifications of these dimensions must be made before supports for the ground mounted or overhead signs can be ordered by the contractor. During stakeout and construction of the structures, bound field or level books shall be used for structure work books in which shall be recorded diagrams and sketches showing location of construction stakes set; complete level notes of elevations set for all parts of the structure and grade hubs; the names of all those doing the survey work, what each person did, and the date the work was done. Structures should be staked using the most accurate equipment and methods at the Resident Engineers disposal. Total stations or transits equipped with electronic distance measuring devices are preferred.

However, with skill, care, and proper procedure, the one minute transit and chain can produce adequate results. Chaining must be done level, utilizing tension handles, and performing any necessary corrections, such as temperature. All angles should be doubled. Distances should be read at least to the nearest For box culverts the lines are centerline of culvert and ends of barrel. Offset grade hubs should also be set for culverts. Hubs with tacks and clearly marked guard stakes shall be used to reference these lines. When grade separations, either highway or railroad, are to be staked, it is the best practice, where possible, to begin the stakeout from the equality on the alignment being spanned. By proceeding in this manner, accumulative differences in chaining or errors in stationing along the line on which the structure is to be built will not affect the horizontal clearance. The Manual For Construction Stakeout should be followed. The sketches represent typical bridge and culvert layouts. They should be varied to suit individual cases. The links to the sketches can be found here. 1. Each measurement, whether a chained distance, angle turned, or elevation given should be checked. One scheme that will serve to check the work is to let entirely different personnel check the layout. This is one scheme of many and would not necessarily involve an entirely new party but a simple change in duties performed. For example, the head chainman could read the plans to check the Party Chiefs plan interpretation, the rear chainman could serve as head chainman to read the measurements between previously placed points, another party member could measure the complement of the angle previously set accumulatively by repeated measurement, elevations could be checked by double rodding from independent bench marks, or a reversal of rodman and levelman duties. This scheme will also serve to provide additional experience and training for party personnel.

All bench marks which are established for use during construction should be, as nearly as practicable, of a permanent nature. Check bench marks used for structure construction with bench marks used for roadway construction. When setting bench marks, avoid setting them in deep embankments that have not set for several months or in any embankments in the vicinity of anticipated pile driving operations. This can be an inconvenience, but problems can arise due to settlement of the bench marks. Levels can be run from bench marks in other areas and temporary bench marks set, or checked, each time critical elevations are necessary, or at least once a week while in use except when pile driving has been taking place. If pile driving has taken place in the vicinity, the temporary bench marks set in embankments should be checked at least daily when in use. Immediately after all concrete the cap has been cast, another check is to be made at each bridge seat using an independent setup of the instrument. Any falsework slippage or excessive settlement will then be apparent. After the first substructure unit has been completed, both of the above checks shall include a check on a bridge seat of a previously cast cap. All rod readings and computations for the above shall be recorded, dated, and initialed in the structure field book. Beam camber shall be corrected to conform to Check camber in screed. The toe of the slope protection should be staked to insure that alignment and grade will conform with that of the roadway. This is usually accomplished by setting one temporary benchmark on a wing wall of each end bent. The elevations are given along the centerline of each girder and are used in computing the height of the

buildups. Tops of girders should be marked with paint at each twentieth point. For longer spans 40th or. The effect of the sun can significantly change girder camber. Levels should be run either early in the morning or on a completely overcast morning.

Deflections shown in the deflection tables are used in the required computations. In some cases, this value will be minus indicating the girder flange projects into the slab. In such cases the Area Construction Engineer should be consulted. The buildup heights for the entire bridge can be computed and listed in a field book well in advance of any forming operation. These heights can be marked on the top of girder at the proper tenth point. The Contractor should be made aware that the computed height is at the centerline of girder and will vary at each side of the buildup depending on the deck cross slope and flange width. Theoretical overhang elevations are no longer supplied and should not be used to grade overhangs. Overhangs can be graded very efficiently by using the overhang typical section and adjusting by a small amount of form settlement and compensating for buildups on the top of the exterior girders or beams. This can be done either with a “preacher” or checking the algebraic difference from the buildup to the overhang with an engineer’s level. It should be noted that bridges with normal crown and similar overhangs on both sides can be graded using one typical section with the algebraic difference between the bottom of slab over the exterior girder or beam and the outside bottom edge of the overhang. A structure with constant superelevation will require two typical section computations. A structure with variable superelevation or varying width overhangs, such as those found on horizontally curved bridges with straight girders, will require a different typical section computation at each grade point if the superelevation or overhang width changes. With this method, it is suggested A quick interpolation between grade points with adjustment for top flange thickness when it changes, can be easily calculated. Stringlining between graded jacks to set other jacks is also acceptable.

Beginning in April 2017 the construction elevations were revised to provide the algebraic difference between the bottom of the slab over the centerline of the exterior girder and the outside edge of the overhang, eliminating the calculations above, with the exception of adding in form settlement.Interpolate in between grades to adjust each overhang bracket or jack to assure uniform grade. It is acceptable to string line between jacks at twentieth points which have been graded, to grade intermediate jacks. All grades can be computed and checked in the structure workbook well ahead of time. The reason construction theoretical grades should not be used and are no longer included in Construction Elevations is to eliminate the effects temperature changes and the constant movement of girders or beams. Using typical sections will assure all overhangs are relative to the girder or beam and therefore a constant slope will be attained on the bottom of overhangs. In an extreme case, it would be possible to have a reverse slope on the overhang bottom if the girder or beam has moved sufficiently down and a theoretical elevation is used. Better results are observed when the transverse screed is graded as outlined below and the header is left 12” low. The screed is allowed to finish over the header to the proper grade. If the contractor elects to use a longitudinal screed contact you Area Construction Engineer for guidance on setting header elevations. A gage stick and carpenters level can be used in adjusting the screed rail to the proper elevation. The screed carriage must be graded to conform to the transverse slope of the deck, taking into consideration the weight of the operator and trowel mechanism. Dry runs should be made in accordance with the procedure at the end of this section to assure proper operation and slab thickness. Links to setup demonstration videos are also included in the procedure.

Pour direction and finishing direction can have drastic effects on the finish, and should be checked during the dry run and discussed at the meeting. Ideally, the dry run should be performed before the PrePour Meeting and the results discussed at the meeting. If a longitudinal screed is proposed to be used, contact the Area Construction Engineer to determine if it is an acceptable application and for assistance with reviewing the setup. The grade for the screed shall be computed accurately and set

in the screed with an engineer's level or a string line. The shape of the screed should end up reflecting the vertical alignment of the road where the screed is set. Computation of screed grades is somewhat complicated for continuous spans when a longitudinal screed is used. Procedures included in the Engineering Control Section of this Manual are recommended. This procedure will minimize unequal beam deflections. As soon as the first overhang has been loaded and the deck concrete has been screeded beyond the second beam, the overhang shall be checked for grade. For full pour simple spans, the grade should be checked with an Engineers level. For simple spans with multiple pours and continuous spans, the overhangs should be checked with a "preacher." Although the "preacher" does not assure exact final grades, it does assure smooth lines on the overhang. Details for constructing a "preacher" are included in the aforementioned procedure for grading overhang forms, headers, etc. If form adjustment is necessary, it should be made immediately. The other overhang should be checked as soon as it is loaded. Final adjustments must be made prior to the dry run. For more detailed discussion of screed setup see Chapter 4 of the Structures II CON 815 Manual and view the Transverse Screed Setup videos on YouTube Construction Unit Training playlist.

Before beginning, at all four corners of the screed the distance from the screed rail up to the carriage rail should be the same and the carriage rail should be straightened Video 1, the rollers should be aligned Video 2, and if the bridge is in a crown section, crown can be adjusted into the truss at this point Video 3. The screed should be pulled to the zero buildup location of one exterior girders. The distance from the buildup to the bottom edge of the front of the drums should be measured. Both legs on this side of the screed should be adjusted identically until the distance measured is equal to the deck thickness plus the buildup. This step should be repeated for the other exterior girder. After this the screed is set to grade Video 4. Begin on one of the exterior girders. At each 20th point or 40th or 60th point on longer spans use the stick constructed in Video 4 to measure up from the top of the girder to the carriage rail. The carriage should be located as close to the exterior girder line you chose as possible and still allow for easy measurement. This measurement should equal the calculated buildup. If the buildup is greater than the calculated buildup, the screed rail should be lowered until the plan buildup is achieved. Conversely, if the buildup is less than the plan thickness, the screed rail should be raised until the calculated buildup is achieved. The screed rail is adjusted by turning the nuts located between the top of the side form and the screed rail saddle. Steps 45 should be repeated for each twentieth point on the exterior girders before checking the interior girders. Any errors found on the interior girders at that point should be minor variations due to incorrect pan elevations or the arithmetic difference in the plan dead load deflection of the particular interior girder and that of the exterior girder. Verify the plan deck thickness from the deck pans to the finish roller and the plan cover over the top mat of rebar.

The thickness and cover should be checked at least every other 20th point or 40th or 60th point at the center of the concrete deck panel or SIP form. This law, comprehensive in scope authorized the U.S. Secretary of Labor to set mandatory occupational safety and health standards for all construction activities. It also provided that existing federal safety standards already enacted under certain acts and in effect as of April 28, 1971, would become a part of the standards. The Occupational Safety and Health Act of North Carolina vests in the North Carolina Commissioner of Labor the authority and responsibility to administer occupational safety and health standards applicable to most public businesses and private entities. Pursuant to NCGS 95131 the occupational safety and health standards adopted under the federal Occupational Safety and Health Act of 1970 are adopted as the occupational safety and health regulations applicable to employers in North Carolina. Pursuant to NCGS 95128 the standards and regulations are applicable to all businesses that are regulated by specific federal laws. Therefore, Contractors performing under any construction contract with the NCDOT are required to comply with all provisions of the North Carolina OSHA regulations. Article 1071 of the Standard Specifications for Roads and Structures

requires that the Contractor observes and complies with all laws and regulations. The Contractor should also be asked to name the employee within the company who is in charge of safety. This name should be recorded in the minutes. During the life of the project, the Resident Engineer and each Inspector should especially observe the operations involving emphasis areas with a safetyoriented view. The emphasis areas include fall protection, crane safety, equipment, and excavation protective systems. The pertinent regulations on these emphasis areas are included in this section of the Manual.

If the Resident Engineer or Inspectors observe a possible violation of the regulations pertaining to the emphasis areas, the Contractor should be advised to take immediate corrective action. Should the Contractor not take immediate corrective action and Department personnel appear to be in danger, the work should be suspended under the provisions of Article 1087 of the Standard Specifications. When there is a question of interpretation of the regulations, the situation should be discussed with the Division Engineer before work is suspended. All verbal communications to the Contractor’s personnel should be documented in writing with a copy to the Division Engineer, appropriate Bridge or Roadway Construction Engineer, the Director of Safety and Risk Management, and the State Construction Engineer. If the Contractor disregards the requests to correct possible violations, the Division Engineer and State Construction Engineer should be advised with the full details. If necessary, the State Construction Engineer or the Director of Safety and Risk Management will request a Department of Labor inspection. If OSHA wants to open an inspection with DOT, the Safety Engineer should be called to participate. Refer to the June 10, 1993, memorandum from L. A. Sanderson to Division Engineers for an explanation of these devices if needed. This includes excavations such as pipe trench storm drain and underdrain, and utility, undercut, drainage structure manhole, foundation, and retaining wall. Competent persons must be identified. NCDOL OSH compliance officers review adherence to the MUTCD. The master is connected to a computer in a central office. The computer can be used to monitor the system, make timing changes and receive reports of signal malfunctions. A dielectric cable contains no metallic components. Used primarily for communications in transportation applications that may cover longer distances than via MMFO cable.