

DIVISION 200

Earthwork



SOUTH CAROLINA
DEPARTMENT
OF TRANSPORTATION

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Section 200

General Guidelines

200.1 PRECONSTRUCTION CONSIDERATIONS

The activities performed at the start of a highway construction project are routine, but critical, because they literally will establish the facility's location in the field and provide for the overall foundation and drainage infrastructure on which the highway will be placed. Mistakes made during this phase of the project can be costly, if not immediately discovered and corrected. Some key activities that will be performed include:

- staking ROW, construction, NPDES and BCA (Bridge Construction Access) lines;
- establishing the facility's alignment, grade and cross-section;
- marking items to remain in place and areas that must not be disturbed;
- installing temporary and permanent erosion and sediment control features;
- clearing and grubbing objectionable and unsuitable materials;
- removing structures and obstructions;
- establishing sources of suitable soil material and excavating borrow pits;
- excavating for the roadbed, drainage and other structures;
- installing subsurface and surface drainage features;
- constructing roadway embankments;
- constructing the facility's subgrade, shoulders and slopes;
- handling and disposing of waste materials (i.e., hazardous and non-hazardous); and
- reclaiming affected public and private properties.

These start-up activities require close inspection and coordination with SCDOT and Contractor personnel, as well as with other affected parties such as utilities, railroads and owners of private properties. Prior to construction and in accordance with the applicable provisions of the Contract, the Contractor is responsible for meeting all permit requirements of Federal, State and local agencies and any permissions required, in the form of written agreements, from affected public and private property owners. Permit requirements, legal issues and regulations should be thoroughly addressed during the Constructability Review and Preconstruction Conference.

At the Preconstruction Conference, the Contractor is required to submit a SCDOT Form 100.15 – Stormwater and Pollution Prevention Plan for Highway Construction. This plan will include detailed half-size plans that define the Best Management Practices (BMPs) required for water quality control by type and project survey station. BMPs are schedules of activities, prohibitions and practices that are employed to control erosion and sediment and to minimize pollution of stormwater run-off and receiving waters both during and after construction.

To ensure good performance and longevity of the pavement structure, continuous and thorough inspection of these initial activities cannot be overemphasized. Pavement structure failures can generally be traced to an improperly constructed embankment, subgrade, subbase, base course or drainage feature. Good field inspection will detect deficiencies early in the project, facilitating immediate corrective action and minimizing future pavement failures. Division 200 provides the

Resident Construction Engineer and SCDOT Inspectors with guidance that should be used in conjunction with sound engineering judgment and field experience to execute these initial construction activities and inspect the construction of earthwork pay items.

200.2 SOIL CONSIDERATIONS

200.2.1 General

Soil is generally considered unconsolidated earthen material that can be excavated. The soils encountered during earthwork will include the insoluble products from either organic decomposition or rock weathering, or some combination of the two. Soils that are highly organic are generally referred to as muck and are not suitable for highway construction. Soils that are the result of rock weathering will generally be suitable for construction, but suitability will depend on the intended construction application.

200.2.2 Unsuitable Soils (Muck)

Organic soil, commonly referred to as muck, is formed when vegetation is deposited in marshy or swampy areas. If the vegetation has rotted or decomposed, the soil will usually be black in color, although some organic silt may range in color from light to dark gray. Organic soil may contain hydrogen sulfide gas, which when wet or heated, will emit an odor similar to rotten eggs.

Muck material will usually be encountered in low-elevation areas where the water table is near or above the surface of the natural ground. Muck that is found in marshy areas of the Coastal Region of South Carolina is usually black and may contain fine sand, which causes it to have a gritty feel. Muck that is found in the swampy areas of other regions of South Carolina will contain very little or no sand, which will have a spongy feel when wet. Muck material has poor engineering qualities and is unsuitable for highway construction. Where muck material is known to exist on the project or where it is encountered during construction, its removal and replacement with suitable soil material is generally required. Where muck must be removed, ensure that it is removed for its full depth, as shown on Standard Drawing 203-1.

200.2.3 Suitable Soils

Most earthwork for highway construction will involve soil material that is composed of the insoluble products of rock weathering. This type of soil usually contains many different types and sizes of granular particles. Generally, the particles will be either bulky or flaky. Bulky particles may be angular, subangular, rounded or subrounded, and flaky particles will be scale-like and extremely thin. Soils that are composed of bulky particles (i.e., sands and gravels) are capable of supporting heavy, static loads but may be easily displaced by vibration. Soils that contain a large percent of flaky particles (i.e. clay and silt) tend to deform easily under static loads but are not greatly affected by vibration. Clay will usually have a greasy or slippery feel when squeezed between the fingertips. Soil materials that are composed of the insoluble products of rock weathering are generally suitable for highway construction, but suitability will depend on the soil's engineering characteristics and intended construction application.

200.2.4 Soil Classification

To assess the suitability of a soil material for an intended engineering application, soil must be sampled, tested and classified. Such procedures are necessary to determine the engineering characteristics of a particular soil, including:

- estimating the extent to which the soil will shrink or swell,
- understanding the soil's subsurface drainage characteristics,
- determining the extent to which the soil can be compacted, and
- assessing suitability of the soil as a fill material.

A mechanical analysis of the soil will be necessary to determine the various sizes of particles (i.e., grains) that are present in the soil. This procedure generally requires separating the clay particles from a soil sample and then shaking the remaining particles through a nest of calibrated sieves. The portion of the sample retained on each sieve represents the relative quantity of each size of particle in the soil.

Soil consistency represents the condition of a soil and its degree of firmness. As a soil changes consistency, its engineering properties also change. The Atterberg Limits (i.e., liquid limit and plastic limit) are a measure of soil consistency.

Upon determination of the sizes of particles in the soil and the soil's Atterberg Limits, the soil may be classified for highway construction purposes. Refer to AASHTO M 145 – Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes.

200.2.5 Moisture Content and Compaction of Soils

Compaction is the action of packing the soil particles together by rolling, ramming or vibrating the material, which decreases the volume of air voids and increases the density of the soil (i.e., weight per unit volume). It is usually expressed as the percent ratio of the soil's in-place density to a standard maximum dry density (i.e., laboratory or one-point proctor). During compaction, the soil must contain a certain quantity of uniformly distributed moisture (i.e., optimum moisture content). Optimum moisture content is the percent of moisture in the soil at which its maximum density can be obtained with a given compactive effort. Optimum moisture content and standard maximum dry density generally will be determined in the field by the One-Point Proctor Method (SC-T-29). Control of compactive effort and moisture content during compaction cannot be overemphasized. The strength of the soil material increases in direct proportion to how much it is compacted. This is especially important for embankment construction.

200.2.6 Embankment Soil Material

An embankment is frequently constructed along a highway to carry traffic over a valley or low lying area and must be capable of supporting the load of the pavement structure and traffic as well as the weight of the embankment itself. The ability of the embankment to adequately support this combined load will depend on:

- strength of the soil material under the embankment,
- engineering characteristics of the embankment material,
- proper construction of benches and transitions,
- proper placement of the embankment material in lifts,
- control of moisture content near optimum during compaction, and
- compaction of each lift of embankment material to target density.

If unsuitable soils or improper construction techniques are used, uneven settlement of the embankment could occur due to consolidation of the soil material. This can be a serious and very expensive problem to correct, which can be effectively minimized through diligent and thorough inspection of methods and materials. Prior to construction, an investigation typically will be performed to assess the suitability of the underlying soil and to evaluate the engineering characteristics of locally available embankment material. To provide a sound embankment structure, the material then must be properly placed, maintained near optimum moisture content and thoroughly and uniformly compacted to target density. See Section 205 and Section 206 for additional information on embankment construction inspection.

200.2.7 Subgrade Soil Material

The subgrade is the foundation of the pavement structure. It is the top 18 inches of the roadbed, unless otherwise defined. Its function is to support, without excessive deflection, the pavement structure (i.e., subbase, base course, surface course) and the vehicular loads applied to it. In some cases, the engineering characteristics of the existing subgrade soil will be capable of supporting these loads. In other cases, however, the heavy loads of project vehicular traffic may require the construction of a special subgrade layer, requiring unsuitable material to be either removed and replaced with suitable material or modified to improve its load bearing capacity. In general, the requirements for subgrade material are identical to those for embankment material (i.e., strength, freedom from shrink and swell, sufficiently rigid to minimize excessive deflection under live loads). In some cases, the subgrade can be very close to the natural ground surface and may be subject to volumetric change due to changes in moisture. Table 1 of AASHTO M 145 – Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes can be used as a general guide for predicting subgrade performance. See Section 208 for additional information on subgrade construction inspection.

200.3 DRAINAGE CONSIDERATIONS

200.3.1 General

One of the most important factors to consider in highway design and construction is the control of surface and subsurface water. Water is arguably the most detrimental natural factor to a highway structure and can come from groundwater, seeps, springs, rain and streams. Unless the flow of water is properly intercepted and moved away from the highway, structural failures will be imminent. Surface and subsurface water are typically controlled through a combination of ditches, pipe and box culverts, aggregate and pipe underdrains and slope drains.

200.3.2 Ditches

Ditches are open channels that are constructed for the primary purpose of collecting and channeling surface water away from the roadway. Where designated, they must be constructed in accordance with the construction details shown on the Contract Plans. It is impractical for the design engineer to address all drainage situations on the project. Therefore, the Roadway Inspector should become familiar with the drainage requirements of the project and ensure that the flow of water is properly controlled during construction. See Section 203 for additional information on ditch construction.

200.3.3 Pipe and Box Culverts

Culverts are constructed of prefabricated lengths of round, oval, arch or box sections of material that are joined together at the proper line and grade to form a tunnel or closed channel. In general, culverts serve the same purpose as ditches, except that a culvert also may be used to channel water under the roadway and carry the overlying load of the highway structure and vehicular traffic. Materials used for pipe culverts vary depending on their application and include reinforced concrete, clay, metal structural plate and polyethylene. Some metallic pipe culverts will require an asphalt coating for durability. See Section 714 for additional information on the construction and inspection of pipe culverts. Box culverts serve a similar function as pipe culverts but are primarily constructed of reinforced concrete sections. See Sections 714 – 722 for addition information on the construction and inspection of box culverts.

200.3.4 Aggregate and Pipe Underdrains

Underdrains generally serve the same function as other drainage structures, except that they act as collectors of subsurface drainage that channel water out and away from the roadbed. Where a high-water table, seep or spring exists or is encountered during construction, underdrains must be properly installed to control the flow of this subsurface water. The Resident Construction Engineer and Roadway Inspector must continually monitor earthwork operations for evidence of subsurface water and ensure that underdrains are properly installed at these locations; otherwise a failure of the pavement structure can be expected. Aggregate or pipe underdrains are generally used for this purpose. Aggregate underdrains consist of entrenched crushed stone constructed on line and grade to allow subsurface water to be intercepted, collected and channeled out from under the roadway through the aggregate material. See Section 801 for additional information on the construction and inspection of aggregate underdrains. Pipe underdrains consist of sections of perforated pipe that are connected and embedded in entrenched aggregate material on line and grade to allow subsurface water to be intercepted, collected and channeled by the pipe out from under the roadway. See Section 802 for additional information on the construction and inspection of pipe underdrains.

200.3.5 Slope Drains

Slope drains are generally constructed along shoulders, slopes and at other locations designated by the Resident Construction Engineer to control surface water flow and prevent erosion. Slope drain pipe may consist of HDPE plastic, corrugated metal, asphalt-fiber or concrete material. See Section 803 for additional information on the construction and inspection of slope drains.

Section 201

Clearing and Grubbing

201.1 DESCRIPTION OF WORK

One of the first items of work on a highway construction project is to clear and grub the areas designated in the Plans. Clearing and grubbing is generally performed within the areas bounded by the construction lines, NPDES lines, BCA lines, ditch and channel areas, designated easement areas and areas within the right-of-way lines that are not designated for protection. Check the Contract Plans, Specifications and Special Provisions. The Contractor will selectively remove and dispose of all vegetation, debris and obstructions that are not designated in the Contract to remain in place (e.g., vegetative undergrowth, trees, stumps, debris, buildings, foundations, abandoned utilities, drainage structures). All protected natural vegetation, rock formations, survey monumentation, historical markers and other objects designated to remain in-place must be marked in the field for preservation and protected from injury and defacement during the operation.

201.2 PRECONSTRUCTION CONSIDERATIONS

201.2.1 Contract Document Review

Review the Contract Plans and Specifications, including Right-of-Way Special Provisions, with the Contractor. Pay particular attention to the Special Provisions related to the protection of the environment, workers and the public.

201.2.2 Permits and Agreements

Verify that the Contractor complies with all applicable Federal, State and local permits, especially those required by SCDHEC. Ensure that any required landowner agreements are properly executed and in-hand prior to the start of work.

201.2.3 Surveying and Staking

Verify that the NPDES lines, BCA lines and right-of-way lines have been staked and that the construction lines have been established by slope stakes. Survey stakes and monumentation must be protected until the Resident Construction Engineer directs otherwise.

201.2.4 Marking of Protected Items and Areas

Check that items and areas that require protection are clearly marked and communicated to the Contractor (e.g., trees, shrubs, plants, utilities, historical sites, wetlands).

201.2.5 Disposition of Items

Review with the Contractor the items and facilities that need to be demolished, removed, relocated or salvaged (e.g., fences, guardrail, utilities, buildings, underground storage tanks, merchantable timber). Pay particular attention to the Special Provisions with respect to ownership of salvageable materials and to the requirements for protecting workers and the environment from hazardous materials.

201.2.6 Removal and Disposal Documentation

Obtain the Contractor's documentation showing that all requirements have been met with respect to removing and transporting construction and hazardous waste to a licensed disposal facility. Retain copies of the manifests and disposal receipts in the project files.

201.3 INSPECTION DURING CONSTRUCTION**201.3.1 Items to Remove**

Unless otherwise specified or directed to be protected, relocated or salvaged, the items to be removed and disposed of during clearing and grubbing include:

- trees, stumps, shrubs, logs and roots;
- dead trees, tree tops and limbs in and over the right-of-way;
- trash, rubbish and debris;
- building framework and foundations;
- fences, posts, signs and other structures;
- utility connections not in service;
- underground storage tanks; and
- other objects, as deemed necessary.

Pay particular attention to the demolition, dismantling and removal of buildings, structures and underground storage tanks to ensure compliance with the Special Provisions and the requirements of SCDHEC.

201.3.2 Erosion and Sediment Control

Verify that the Contractor is limiting the erodible area and has in place the proper erosion and sediment control measures. Pay particular attention to the Contractor's type and scheduling of installing erosion control measures. They should be of the type specified and installed prior to each soil disturbing operation. Notify the Resident Construction Engineer immediately if additional measures are needed. Perform inspections of the controls, as required by the NPDES permit, to ensure proper operation and adequate maintenance. Verify that temporary seeding is placed on areas that will remain inactive for longer than 21 days. See Section 815 for additional information on erosion and sediment control.

201.3.3 Merchantable Timber and Salvageable Materials

Verify that trees of value to be removed are being sawed into merchantable lengths and stacked within the right-of-way, or as otherwise designated by landowner agreement. Ensure that the Contractor does not cut, damage or destroy any timber outside the construction lines, except as designated by the Resident Construction Engineer. Verify that salvageable materials are properly removed and stored without damage.

201.3.4 Clearing and Grubbing within Right-of-Way

Check that the Contractor is clearing and grubbing the full width of the right-of-way, including all NPDES areas, BCA areas and all necessary cut and fill slopes that extend beyond the right-of-way line. Verify that tree tops, damaged trees and other debris within the right-of-way are being cleared. Make certain the Contractor does not cut, damage or destroy timber outside the right-of-way lines, unless otherwise directed.

201.3.5 Clearing and Grubbing within Roadway

Check that the Contractor is clearing and grubbing the full width of the construction limits as shown on the plans. Verify that tree tops, damaged trees and other debris are being removed. To reduce maintenance problems, trees with limbs hanging over the roadway must be trimmed to an 18-foot clear height. Measure this for compliance as the work progresses. In addition, dead or damaged trees adjacent to or overhanging the right-of-way that may become a maintenance problem should also be removed. Check with the Resident Construction Engineer prior to encroaching onto adjacent property. Ensure that any additional widths designated on the Contract Plans are being cleared. Check the depth of grubbing for compliance.

201.3.6 Clearing and Grubbing at Intersections and Interchanges

Check that the Contractor clears and grubs the full width of the right-of-way provided at intersections and interchanges, including sight triangles. Sight triangles at road intersections will be designated on the Contract Plans. Pay particular attention to the staking of the sight triangle in relation to the construction lines and the edge of traveled way, as shown on the Contract Plans. The entire sight triangle must be cleared; however, check with the Resident Construction Engineer to see if there are any trees or shrubs that warrant transplanting rather than clearing.

201.3.7 Clearing and Grubbing at Bridge Sites

Verify that bridge sites are cleared and grubbed past the outer edges for the full width of right-of-way and beyond the beginning and end of the bridge, including the BCA area, unless otherwise directed. The area within the BCA (i.e., Bridge Construction Access) lines will be cleared and grubbed during construction, and a silt fence will be installed along the outer most limits of the BCA lines. A minimum of 20 feet is required between the toe of fill and BCA line.

201.3.8 Clearing and Grubbing Excavation Areas

Verify that all excavated areas are completely grubbed of all vegetation.

201.3.9 Clearing and Grubbing Embankment Areas**201.3.9.1 Embankment Fills**

Pay particular attention to locations where embankments will be constructed. All vegetation must be grubbed in these areas. Check the depth of grubbing for compliance as it relates to the height of fill on the cross-sections. Stumps must be completely removed in areas where fills will be less than 5 feet high; otherwise stumps can extend no more than 8 inches above the groundline or low water level, as measured from the base of the stump. Verify that stump holes are backfilled with suitable material and thoroughly compacted.

201.3.9.2 Flattening Fill Slopes

Where suitable surplus soil material is available and the adjacent landowner approves the work via SCDOT Form 200.04 – Agreement for Placing Debris on Private Property or SCDOT Form 100.14 – Slope Permission, as appropriate, the area beyond the toe of fill may be extended to flatten the slope and enhance roadside safety. The Resident Construction Engineer must authorize this work, and may need approval from the District Construction Engineer before proceeding, which will be determined on a case-by-case basis. Where this work is approved, the extended area must be cleared and grubbed.

201.3.10 Waste Disposal Methods

Check compliance of all disposal methods used within the right-of-way (e.g., burning). Verify that the proper disposal sites have been secured for the type of waste generated (e.g., construction waste, hazardous waste). Disposal sites are regulated by SCDHEC. Retain copies of manifests and disposal receipts in the project files.

201.4 POST-CONSTRUCTION CONSIDERATIONS

Do not allow grading work to begin on a section of the project until the full extent of clearing and grubbing has been completed and approved, as directed by the Resident Construction Engineer. Inspect the cleared and grubbed areas well in advance of the grading operation to minimize interference with the Contractor's grading forces. Clearing and grubbing should be inspected and approved as the work progresses, rather than waiting until the clearing and grubbing personnel have moved off the project. The Contractor may elect, however, to wait until the grading force has arrived to remove such debris as weeds, leaves and other light vegetation. Ensure that the Contractor has preserved all items designated to remain. Any damage found will be assessed and withheld from payment to the Contractor.

201.5 DOCUMENTATION AND PAYMENT CONSIDERATIONS

201.5.1 Clearing and Grubbing Roadway and Right-of-Way (Lump Sum Basis)

Document acceptability in the Daily Work Report of the areas cleared and grubbed within the roadway and right-of-way. Once completed and approved, these pay items will be paid for on a lump sum basis, adjusted as provided for in the Contract for changes to project length. Such length adjustments will be made by applying a unit price per length, as determined from the original project length and the lump sum bid amount. Note in the Daily Work Report, for later assessment, any fines from other agencies and damage to protected items and areas, salvageable materials, merchantable timber and utilities. Keep accurate notes of the work in progress. SiteManager will maintain a record of the quantities paid and pending, and payment may be initiated once the Resident Construction Engineer approves the Daily Work Report and processes the Monthly Pay Estimate.

201.5.2 Clearing and Grubbing Other Areas (Unit Area Basis)

Measure and document in the Daily Work Report the actual surface area (i.e., width x length), based on field stakes, for the following approved cleared and grubbed areas:

- NPDES and BCA areas;
- channel changes within the right-of-way, not shown on the Contract Plans;
- borrow areas within the right-of-way, not shown on the Contract Plans;
- channel changes outside the right-of-way;
- ditches outside the right-of-way;
- areas for flattening slopes beyond the typical sections; and
- areas where work is extended (e.g., frontage road) without increasing project length.

Payment for these areas will be made based on the Contract unit price for ditches, or as otherwise directed. Keep accurate notes of the work in progress. SiteManager will maintain a record of quantities paid and pending, and payment may be initiated once the Resident Construction Engineer approves the Daily Work Report and processes the Monthly Pay Estimate.

Section 202

Removal of Structures and Obstructions

202.1 DESCRIPTION OF WORK

The Resident Construction Engineer and SCDOT Inspectors will be responsible for ensuring that the Contractor removes and disposes of structures and obstructions as designated and in accordance with the Contract Plans and Specifications, including salvaging materials and backfilling holes where appropriate. See Section 104.8 for additional information on the removal and disposal of structures and obstructions and Section 808 for information on relocating structures and other items on the project.

202.2 PRECONSTRUCTION CONSIDERATIONS

202.2.1 Project Assessment

Prior to construction, the following will be obtained for each item within the right-of-way:

- type of object (e.g., building, drain field, septic tank, underground fuel tank, utility);
- location of the object (i.e., distance left or right of centerline);
- description of object (e.g., dimensions, hazards, utility connections, active status);
- disposition of the object (i.e., move, reset, demolish);
- description of the work to be performed (e.g., salvage, dispose); and
- owner name and contact information.

On projects other than "C" projects, the District Engineering Administrator will obtain this information within 4 weeks of receiving preliminary right-of-way plans from the Road Design Section. Once obtained, the District Engineering Administrator will forward the information to the Road Engineer-Design, who, in turn, will forward a copy with the right-of-way plans to the Right-of-Way Section. For "C" projects, this information will be obtained during the Design Field Review. Check the right-of-way Special Provisions of the Contract for this type of information.

202.2.2 Contract Document Review

Review with the Contractor the items and facilities that need to be demolished, removed, relocated or salvaged (e.g., utilities, buildings, structures, underground storage tanks). Pay particular attention to the Special Provisions with respect to ownership of salvageable materials and to the requirements for protecting workers and the environment from hazardous materials.

202.2.3 Building Structures

Verify that the Contractor has performed the required Asbestos Investigation and has obtained the proper permits from SCDHEC. The Resident Construction Engineer will be responsible for

signing SCDOT Form 200.05 – Notification of Demolition on behalf of SCDOT prior to its submittal to SCDHEC.

202.2.4 Bridge Structures

For projects requiring the removal of a bridge structure, the Resident Construction Engineer will notify the Geotechnical Materials Engineer at the Research and Materials Lab that an Asbestos Investigation is needed for the bridge structure if not included in the contract. The Asbestos Investigation Report will be forwarded to the Resident Construction Engineer. At least 10 working days prior to the start of demolition, the Resident Construction Engineer will prepare and submit SCDOT Form 200.05 – Notification of Demolition to SCDHEC. The Resident Construction Engineer and the Contractor must sign the form. A copy of the Asbestos Investigation Report must accompany the submittal.

202.2.5 Underground Storage Tanks

Ensure that any removal and disposal of underground storage tanks is in accordance with the Contract Plans and Specifications, including Special Provisions, and the requirements of SCDHEC regulations.

202.2.6 Landowner Agreements

Verify that the Contractor has obtained all required landowner agreements with respect to encroachment, use and disposal of construction debris off right-of-way. Check to ensure that property owner release has been obtained.

202.2.7 Contractor Certification of Permits

Obtain the Contractor's documentation showing that all permit requirements have been met with respect to removing hazardous waste and transporting construction waste and hazardous waste to a licensed disposal facility. Retain copies of the documentation, manifests and disposal receipts in the project files.

202.3 INSPECTION DURING CONSTRUCTION

202.3.1 Building and Structures

Buildings, foundations, fences, structures and other obstructions within the right-of-way and outside the right-of-way, as designated, will be razed and disposed of properly. Consider the following:

1. Utilities. Ensure that utility connections (e.g., sewer, gas, water, power) have been shut off and capped. Utility materials must be carefully stored and protected.

2. Foundations. Outside the construction lines, check that foundations are removed to the specified depth below the natural ground level. Inside the construction lines, check that foundations are removed to the specified depth below the subgrade elevation.
3. Basements. Verify that basement floors are broken up to promote drainage. Basement cavities must be backfilled with suitable material and compacted, as specified.
4. Pavement/Curb and Gutters. Check that pavement and curb and gutter to remain is left in good condition.

202.3.2 Bridges and Culverts

All designated items and those found that will interfere with the new structure must be completely removed (e.g., culverts, arches, pipe, tile). Note that pavements, sidewalks and curbs that are removed may be suitable for use in embankment construction. Check with the Resident Construction Engineer. Consider the following guidelines during the removal of bridges and culverts:

1. Hazardous Materials. Check compliance with removal and disposal of items containing lead-based paint and other hazardous materials.
2. Traffic Control. Verify that arrangements to accommodate traffic have been made and that the Contractor is in conformance with the approved Traffic Control Plan and the requirements of the *MUTCD* (see Section 601). Verify that traffic control is in place before drainage structures used by traffic are removed.
3. Blasting. Blasting must be approved by the Resident Construction Engineer. Verify that the Contractor has coordinated with the South Carolina Department of Natural Resources District Fisheries Biologist and the District Law Enforcement Captain before blasting in any waterway.
4. Depth of Removal. Verify that structures have been removed down to the natural stream bottom and that structures outside the stream have been removed to 1 foot below the natural ground.
5. Shoring. Ensure that all excavation work adjacent to culverts and bridges and its approaches have been adequately shored.
6. Salvageable Materials. All designated pipe and tile drains must be removed in a careful manner and neatly stored on-site, unless they are to be relaid as part of the Contract. If required, steel and wood bridges must be carefully dismantled without damage. The Resident Construction Engineer will designate the on-site storage location. Check salvageable materials for damage during removal, handling and storage.

202.4 POST-CONSTRUCTION CONSIDERATIONS

The removal of all buildings, structures and underground facilities must be completed and approved by the Resident Construction Engineer prior to initiating further work on the project section. Ensure that inspections are completed in a timely manner so as not to hold up the Contractor's operations. Pay particular attention to the disposal of the construction debris and any hazardous materials generated from the operation. Construction debris must be disposed of outside the limits of view of the traveled way and, if off-site, in accordance with landowner agreements. Note any damages to salvageable materials that are the property of the Department. Assessments will be made and deducted from payment to the Contractor for any such damage.

202.5 DOCUMENTATION AND PAYMENT CONSIDERATIONS

202.5.1 General

Document in the Daily Work Report, for later assessment, any fines issued to the Contractor by other agencies. If the Contract does not specify pay items for removal of structures and obstructions or the removal is not measured and paid for as other items of work, the work will be performed as discussed in Section 104.8 and Section 201.

202.5.2 Buildings and Other Facilities (Lump Sum Basis)

After removal and disposal, document acceptability in the Daily Work Report of each building, utility, underground storage tank, etc. itemized in the Contract. Once completed and approved, pay for each of these items on their respective lump sum in the Contract. Also, document in the Daily Work Report the volumetric quantity of approved and accepted backfill required to fill cavities generated from the removal of these facilities. Pay for this backfill based on the Contract price per unit volume for unclassified or borrow excavation, as deemed appropriate. Do not measure for separate payment any such facility that is not itemized in the Contract, because removal and disposal of such items will be incorporated elsewhere.

202.5.3 Bridge Structures (Lump Sum Basis)

After removal and disposal, document acceptability in the Daily Work Report of each bridge structure itemized in the Contract. Once completed and approved, pay for each bridge structure based on the lump sum in the Contract.

202.5.4 Reclamation of Existing Roadways

202.5.4.1 Non-Itemized Pavement or Curb Removal (Unit Volume Basis)

Where existing pavement or curb has been removed but not itemized in the Contract, document acceptability in the Daily Work Report and measure and pay for the work as unclassified excavation. See Section 203 for additional information.

202.5.4.2 Pavement (Unit Area Basis)

Document in the Daily Work Report the accepted area of existing pavement removed and disposed. The quantity will be determined by actual surface area (i.e., length x width) made in the field prior to removal. Pay for this work based on the Contract unit price per area. Note that areas extending beyond the construction lines will be identified on the Contract Plans and must be included for payment.

202.5.4.3 Removal of Asphalt Pavement < 2 inches

Document in the Daily Work Report the accepted area of existing pavement (i.e., < 2 inches in thickness) removed and disposed. Pay for this work as unclassified excavation.

202.5.4.4 Removal of Asphalt Pavement \geq 2 inches

Where existing asphalt pavement has been removed (i.e., \geq 2 inches), document acceptability in the Daily Work Report. The quantity will be determined by actual horizontal area (i.e., length x width) made in the field prior to removal. Pay for this work based on the Contract unit price per area. Note that areas extending beyond the construction lines will be identified on the Contract Plans and must be included for payment.

202.5.4.5 Curb (Unit Length Basis)

Document in the Daily Work Report the accepted length of existing curb removed and disposed. The quantity will be determined by actual linear measurements made in the field prior to removal. Pay for this work based on the Contract unit price per length.

202.5.4.6 Earth Roadway (Unit Area Basis)

Where it is necessary to reclaim an existing earth roadway, the area outside the construction lines will be scarified, graded to drain and seeded as shown by crosshatching on the Contract Plans. Document in the Daily Work Report the accepted area of existing earth roadway reclaimed. The quantity will be determined by actual surface area (i.e., length x width) made in the field prior to removal. Pay for this work based on the Contract unit price per area. Note that areas extending beyond the construction lines will be identified on the Contract Plans and must be included for payment.

202.5.5 Culverts

Where existing culverts are removed, document acceptability and quantities in the Daily Work Report and measure and pay for the work as provided for in the Contract Specifications and Special Provisions.

Section 203

Roadway and Drainage Excavation

203.1 DESCRIPTION OF WORK

The Resident Construction Engineer and SCDOT Inspectors will be responsible for ensuring compliance of roadway and drainage excavation. In general, the Contractor will be required to excavate and dispose of unsuitable material; stockpile and reuse suitable materials; and obtain, haul, place and compact material within the right-of-way for embankment, subgrade, shoulder, slope and intersection construction. All clearing and grubbing for a given section must be completed and approved by the Resident Construction Engineer prior to initiating grading operations in that area. The SCDOT Inspector assigned to the grading work must be thoroughly familiar with the method of staking, soil test reports, typical sections, planned drainage facilities and the material sources that will be used on the project. As the excavation work progresses, the SCDOT Inspector must make sure that the Contractor is constructing each section in accordance with the Contract Plans, paying particular attention to the construction of slopes.

203.2 PRECONSTRUCTION CONSIDERATIONS

203.2.1 Contract Document Review

Review with the Contractor the Contract Plans and Specifications for the roadway and drainage excavation to be performed. Pay attention to the Special Provisions with respect to material reuse and disposal, material testing, acquisition and reclamation, landowner agreements, protection of workers and the environment, and erosion and sediment control.

203.2.2 Permits and Agreements

Verify that all applicable Federal, State and local permits (e.g., SCDHEC) have been obtained. Ensure that any required landowner agreements are properly executed and in-hand prior to the work.

203.2.3 Surveying and Staking

Verify that the NPDES lines, BCA lines and right-of-way lines have been staked and that the construction lines have been established by slope stakes. Survey stakes and monumentation must be protected until the Resident Construction Engineer directs otherwise. Check slope stakes for compliance with the typical sections and verify that lines and grades are as shown on the Contract Plans, or as otherwise directed by the Resident Construction Engineer. Ensure that all necessary cross-sections have been taken prior to the Contractor beginning work. The digital terrain method is acceptable for borrow pit cross-sectioning, and the grid method will be used to measure bridge and other similar excavation.

203.2.4 Material Pits and Haul Roads

Borrow pits will generally be provided by the Contractor. Ensure that the Contractor has obtained the permits and agreements required by SCDHEC, NPDES and landowners. Verify with the Contractor the exact location and limits of the pit that will be used for the Contract. This is especially important if the pit will be used for other contracts during the project. Check the Contract Plans for any haul roads required for hauling borrow material. Ensure that the Contractor restores all pits and haul roads to a condition satisfactory to property owners, as required by the South Carolina Mining Act.

203.2.5 Sampling and Testing Considerations

203.2.5.1 Borrow Pits

The sampling and testing of borrow pit material is generally the responsibility of the Contractor. Check the Special Provisions of the Contract. Any additional sampling and testing desired by the Resident Construction Engineer will be performed only for the purpose of assessing suitability of the material with respect to the requirements of the Contract Specifications. These samples and tests must be performed well in advance of the grading operation. SCDOT does not approve borrow pits.

203.2.5.2 Excavation Areas

If an area of questionable material is encountered, it may be necessary for the Resident Construction Engineer to request additional borings for the purpose of verifying shrink/swell and suitability. This will be determined on a case-by-case basis. The Resident Construction Engineer should contact the Research and Materials Laboratory to arrange the use of any needed boring equipment. See Section 106 for additional information on control of materials.

203.2.6 Material and Equipment Considerations

Where geotextile fabric will be used on the project, verify that the material meets the Contract specifications for its intended use. Obtain the manufacturer's certification from the Contractor and submit it to the Research and Materials Laboratory prior to use. See Section 300.2.5 for additional information. Check the condition of the equipment to be used on the project.

203.2.7 Resetting of Items

Verify that any items required to be reset (e.g., mailboxes, guide signs, traffic control signs, traffic warning signs, guardrail) have been properly reset without damage. The Contractor is responsible for executing SCDOT Form 800.01 – Agreement for Moving Items Release. The Resident Construction Engineer must sign this form.

203.3 INSPECTION DURING CONSTRUCTION

203.3.1 Erosion and Sediment Control

Verify that the Contractor is limiting the erodible area and has in place the proper erosion and sediment control checks to protect adjacent rivers, streams, wetlands and impoundments. Pay particular attention to the Contractor's type and scheduling of installing these checks. They should be of the type specified and installed prior to each soil disturbing operation. Notify the Resident Construction Engineer immediately if additional measures are needed. Perform inspections of the controls, as required by the NPDES permit, to ensure proper operation and adequate maintenance. Verify that erodible areas have been sloped and seeded and that temporary seeding is placed on areas that will remain inactive for longer than 21 days. See Section 815 for additional information on erosion and sediment control.

203.3.2 Removal of Unsuitable Material (Muck Excavation)

203.3.2.1 General

Unsuitable material is organic muck or soft, pumping, extremely wet material. See Section 200.2 for information on soils. During the work, continually monitor the site for areas that are unstable for foundation, subgrade or other roadway purposes. Ensure that the Contractor removes and disposes of unsuitable material to the cross-section shown on the typical sections and backfills the excavation with suitable material.

203.3.2.2 Excavation Near Watercourses

Verify that all roots, stumps, rock and other unsuitable materials along the sides and bottom of watercourses are cut to conform to the slope, grade and shape of the typical sections. Check that material is not deposited within 3 feet of watercourse edges. Verify that suitable material excavated from ditches and channels is placed in the embankment or along the banks.

203.3.2.3 Subgrade and Underdrains

As the excavation work nears the subgrade elevation, observe the cut for any unusual displacement of the ground by earthmoving equipment. Abnormal displacement may occur because of subsurface moisture or because of the instability of the material. Should either condition exist, the cause should be determined and corrected, if necessary, by placement of interception ditches and underdrains, removal of the unstable material or other appropriate means. Consult the Resident Construction Engineer and, as needed, the District Construction Engineer, for advice when unsuitable material is encountered, causing the need for underdrains. Use sound engineering judgment in determining mitigation plans. Additional boring and soil testing may be necessary. See Section 200.3.4 for additional information on underdrains and Section 208 for additional information on subgrade. The District Construction Engineer must approve the subgrade prior to further work.

203.3.3 Reuse of Suitable Material

Ensure that any stripped material that is determined by the Resident Construction Engineer to be beneficial to the establishment of permanent vegetation on the project is salvaged and stockpiled for later use on the project. Check the Contract Plans for designated areas of surplus and waste materials.

203.3.4 Ditches and Channels

Satisfactory drainage is often difficult to obtain, especially in areas with flat terrain. Ditches should drain away from the roadway. Cut ditches should be flared out away from the roadbed at the end of cuts and extended on the natural ground to a point where water will not be discharged along the junction of the fill slope and the natural ground. After ditches are constructed, their performance should be observed to determine if destructive erosion is taking place. On primary and Interstate projects, a bid item will usually be provided for the paving of ditches that may otherwise erode excessively. When such an item is provided, the Resident Construction Engineer should determine locations where placement of ditch paving will be performed. The Contractor should be advised of these locations well in advance of the completion of the project. For ditches and channels, the Resident Construction Engineer must approve any deviation from the Contract Plans.

203.3.5 Borrow Excavation

It is often necessary to borrow material to balance earthwork, because the shrink/swell factor does not agree with the design factor. Borrow material may be obtained by widening cuts, flattening cut slopes, lowering grades or by obtaining borrow pits. Grade adjustments on primary roads and Interstate projects and those greater than 0.3 feet on secondary roads should be avoided and require approval by the District Construction Engineer.

203.3.6 Rock Excavation

Where rock is encountered in the subgrade, verify that the rock is excavated to a depth of 6 inches below subgrade for the entire width of the roadbed, unless a cement-modified subgrade is specified in the Contract Plans. Where the plans specify a cement-modified subgrade and rock is encountered in the subgrade, ensure that the rock is excavated to a depth of 12 inches below the subgrade for the width specified in the Contract Plans, or as otherwise directed by the Resident Construction Engineer. Ensure that the resulting excavated areas are backfilled with suitable material. Verify that final breakage of rock excavation conforms to the slope required by the Contract Plans. Check with the Resident Construction Engineer prior to any pre-splitting blasting operation. Ensure that the pre-split face does not deviate more than 6 inches from the front line of the drill holes nor more than 12 inches from the back line. Watch for pre-split holes that did not detonate. See Section 107.15 for information on the use of explosives.

203.3.7 Embankment Construction

As practicable, ensure that the Contractor salvages the best excavation material for use in constructing the top portion of embankments. Verify that any material excavated beyond the slope stakes is used in the formation of the embankments, as applicable. Check that ditches and gutters discharging from cuts to embankment areas are constructed to avoid erosion of the embankment. Verify that final slopes are left reasonably smooth and uniform. Unless otherwise permitted, ensure that no rock projects more than 1 foot beyond established slopes.

203.3.8 Select and Surplus Material

Check that the Contractor strips and stockpiles select material for shoulders. Ensure that surplus or waste material is used to flatten embankment slopes, where practicable.

203.4 POST-CONSTRUCTION CONSIDERATIONS

Roadway and drainage excavation must be completed and approved by the Resident Construction Engineer prior to initiating further work on the project section. Ensure that inspections are completed in a timely manner so as not to hold up the Contractor's operations.

203.5 DOCUMENTATION AND PAYMENT CONSIDERATIONS

See Section 203 of the *Standard Specifications* for the method of measurement and basis of payment for roadway and drainage excavation. Use the Daily Work Report and appropriate SCDOT Construction Forms to document field notes, measurements and the day-to-day project activities for assessing acceptability and measuring work and materials for payment.

Section 204

Structure Excavation

204.1 DESCRIPTION OF WORK

Structure excavation consists of the removal and disposal of all materials necessary for the construction of foundations and substructures for bridges, box culverts and other structures. When specified, the Resident Construction Engineer and SCDOT Inspectors will be responsible for ensuring compliance with the Contract Plans and Specifications.

204.2 PRECONSTRUCTION CONSIDERATIONS

Review the Contract Plans and Specifications, including applicable Supplemental Specifications and Special Provisions, to understand the requirements and limitations for structure excavation. Pay particular attention to the criteria specified for assessing acceptability and for measuring the work for payment.

204.3 INSPECTION DURING CONSTRUCTION

204.3.1 Bridge Excavation

Excavation for bridges will be classified as either dry, wet, wet and dry, or rock. Excavation for other structures will be unclassified. The Contract Specifications will define the classifications for bridge excavation. In some cases, the Resident Construction Engineer may experience some difficulty in determining the portion of excavation that is to be classified as rock excavation. Boulders must be larger than 0.5 cubic yards to be classified as rock excavation. The rock must be of such hardness that blasting is required in most instances of removal. Material which may be commonly called rock but that can be broken up with a pneumatic jack hammer, chisel or spade point cannot be classified as rock excavation, because it does not meet the specified requirements for rock excavation. The classification between wet excavation and dry excavation will be specified in the Contract Plans and Specifications, unless a price is obtained for the combination of wet and dry excavation, in which case there will be no distinction made between wet excavation and dry excavation. Only when a price for rock excavation is itemized in the Contract Plans and Specifications will any rock excavation be paid for.

204.3.2 Cofferdams

Where cofferdams must be constructed, verify that the design calculation and Shop Plans (see Section 725) have been submitted for review prior to construction. Also, ensure that the cofferdam is kept free of water by pumping during construction.

204.3.3 Foundation Seals

For foundation seals, check the elevation of the foundation seal to ensure that it is within conformance of the grade specified on the Contract Plans. Also, check the placement of concrete for conformance with specified requirements.

204.4 POST-CONSTRUCTION CONSIDERATIONS

Verify that crosshole sonic logging is performed on drilled shafts, as required (see Section 712). All work related to structural excavation must receive final approval from the Resident Construction Engineer prior to any other work proceeding at the site. The Bridge Construction Engineer must approve any work that deviates from the Contract Plans.

204.5 DOCUMENTATION AND PAYMENT CONSIDERATIONS

Document in the Daily Work Report the quantity of excavation to be paid for that was actually removed within the limits defined in the Contract Plans and Specifications. Prior to excavation, the Resident Construction Engineer will determine the elevation of the ground or stream bed at a sufficient number of points. These original elevations should be made to the nearest 0.1 foot.

1. Bridge Excavation. A grid system can be used to measure excavation for most bridge footings. This simplifies computations. Once the transverse centerline of the foundation has been staked, the corners of the excavation, as defined by the limits for payment, should be determined and elevations taken at each corner and at the center of each side. Elevations should also be taken at the intersection of lines joining the opposite side mid-points. This will form the grid system. Additional points along the sides may be necessary if the foundation is large or if the top of the ground is rough. The average ground line can then be determined by multiplying the elevation of each point by the number of rectangles of the grid that make contact with the point and dividing the sum by four times the number of rectangles in the grid. If the Contract specified a unit price for rock excavation and the unit price is substantially higher than that for unclassified excavation, the average elevation of the top surface of the material that qualifies as rock must be determined in a similar manner. Final elevations of the bottom of the excavation should be taken at the same points and the average elevation similarly determined. The volume can then be computed by multiplying the difference between the average elevations by the area of the excavation authorized for payment.
2. Culvert Excavation. The Contract will define the method to be used in measuring excavation for culverts. Cross-sections should be taken perpendicular to the centerline of the culvert at sufficient intervals, and the volume computed by average-end-area method. The digital terrain method of using total stations may also be used.

Payment will be made at the Contract unit price for the volume of the various classifications of excavation involved, except that wet excavation and rock excavation for bridges, whose final footing elevations are more than 5 feet below plan elevation for the bottom of the footing, will be paid for at an increase in price as specified in the Contract.

Section 205

Embankment Construction

205.1 DESCRIPTION OF WORK

Embankment construction is one of the most important phases of highway construction, and if acceptable results are to be obtained, diligent inspection must be provided. The importance of diligently inspecting the acceptability of this work and maintaining accurate notes in the Daily Work Report cannot be overemphasized. Mistakes occurring during this phase of construction can be costly, especially if they are covered over by a subsequent operation such as paving. The Resident Construction Engineer and SCDOT Inspectors will be responsible for ensuring that the Contractor constructs embankments as specified in the Contract. Embankment construction generally consists of forming embankments to the lines, grades and cross-sections in the Contract Plans, including preparing areas on which they will be placed, placing and compacting approved material where unsuitable material has been removed, and placing and compacting material in holes, pits and other depressions within the roadway area.

205.2 PRECONSTRUCTION CONSIDERATIONS

205.2.1 Contract Document Review

Review the Contract Plans and Specifications, including applicable Supplemental Specifications and Special Provisions, to understand the requirements and limitations for embankment construction. Pay particular attention to erosion and sediment control, work and material acceptance criteria and the documentation and measurements required for payment.

205.2.2 Sampling and Testing Considerations

The actual dry density will be determined using SC-T-30, SC-T-31, SC-T-32 or SC-T-33, as appropriate. The maximum dry density and the optimum moisture content will be determined using either the One-Point Proctor Method (SC-T-29) or the field method of determining moisture-density relationship (SC-T-25). The frequency of density testing must be performed in accordance with the minimum criteria presented in Section 106, but should be increased, as needed, to closely monitor compaction, such as in areas where fills are short, existing embankments are widened and when changes are noted in soil conditions (e.g., color, texture). Either SC-T-29 or SC-T-25 should be performed each time a change in soil condition is noted. Even if the soil remains fairly uniform, it will still be necessary to conduct a minimum of two tests each day using either SC-T-25 or SC-T-29, preferably one in the morning and one in the afternoon. Use previous experience and sound engineering judgment to assess the need for additional testing. In addition, if the Special Provisions require the material to be a certain AASHTO or ASTM classification, a minimum of one sample will be required from each source used that day. See Appendix C for SCDOT Sampling and Testing Procedures.

Submit embankment material samples to the Research and Materials Laboratory for testing. Include on the Sample Identification Card (see Appendix B) the survey station number, distance from centerline and approximate depth below the finished grade. If the Test Report from the Research and Materials Laboratory indicates the sample failed and a check sample is requested, obtain and forward to the Research and Materials Laboratory two check samples representing the failing material. Check samples are discussed in Section 106.

Maintain a full record of density tests and test results in the project files. The Resident Construction Engineer should retain SCDOT Form 200.02 – Percent Compaction by Nuclear Gauge or SCDOT Form 200.03 – Percent Compaction by Nuclear Gauge – Direct Read Gauge; however, SCDOT Form 200.01 – Field Density Test Report (Nuclear Gauge) must be sent to the Research and Materials Laboratory on a weekly basis. Report the location of each density test, including survey station number, distance from centerline and depth below the finished grade.

205.3 INSPECTION DURING CONSTRUCTION

205.3.1 Embankment Foundation

Inspection of an embankment foundation is essential and involves an appraisal of existing conditions. Ensure compliance of the clearing and grubbing work. Examine the foundation for soft or saturated material and evidence of seeps or springs. Watch for spongy material. Ensure that soil of questionable bearing is removed, replaced and satisfactorily drained. Contact the Resident Construction Engineer for any needed assistance. Pay particular attention to obtaining the best possible interlock between existing sloped ground and new embankment material. On hillsides, benching will be required to prevent slides and ensure a positive interlock between the embankment and its foundation.

205.3.2 Formation and Compaction

The ability of an embankment to support itself, the pavement structure and traffic loading depends greatly on how well each lift is placed and compacted and how well the embankment is drained. If improperly compacted or if it becomes saturated, the embankment will fail. Ensure that the required drainage for the embankment is properly installed. As the embankment is being constructed, check the drainage structures for any failures that may have occurred and, if found, halt embankment construction in the area until the condition has been corrected. Verify that each lift is placed in successive, horizontal and uniform compacted layers. Verify that the thickness of each lift complies with the *Standard Specifications*. Lifts that are placed too thick, too dry or too wet may not achieve target density when compacted. In addition, by controlling lift thickness, hauling equipment will make more passes over the embankment area, thus resulting in additional compactive effort. Verify that each lift is compacted to a minimum 95% of maximum density. The Contractor is responsible for obtaining the required density by any means desired. Where a swampy area is encountered and it is not necessary to remove the soft material, it may be necessary to place a foundation lift greater than 8 inches thick. This prevents the underlying material from being pumped up into the embankment. For the top portion of the embankment, only the best available embankment material should be used. This

policy should be strictly enforced. By doing so, the supporting ability of the embankment will be greatly improved. See Section 205.2.2 for information on compaction sampling and testing.

205.3.3 Embankment Over and Around Structures

Where embankment material is placed over or around structures (e.g., box culverts, retaining walls), verify that the concrete has cured for at least 14 days prior to any backfilling or that the concrete has achieved desired strength. Ensure that embankment material is placed and compacted in equal lifts on both sides of concrete structures to avoid unbalanced earth pressures. If embankment material has been brought up more than one-half of the height of a box culvert, check that the remainder of the material is placed the same day to provide the minimum cover. Ensure that drains connecting weepholes have been installed, as specified.

205.4 POST-CONSTRUCTION CONSIDERATIONS

No pavement structure will be placed until the underlying embankment work has been tested and approved by the District Construction Engineer.

205.5 DOCUMENTATION AND PAYMENT CONSIDERATIONS

The Resident Construction Engineer will retain the original and final roadway cross-sections. Although embankment will be measured separately for payment, the cross-sections will be necessary to compute embankment volume and any overhaul quantities.

Section 206

Embankment In-Place

206.1 DESCRIPTION OF WORK

The Resident Construction Engineer and SCDOT Inspectors will be responsible for ensuring the Contractor performs this work in accordance with the Contract Plans and Specifications. The work for embankment in-place generally consists of the construction of embankment by dredging and pumping acceptable material from rivers, canals or other areas or by excavating, loading and hauling acceptable material from pits and depositing the material at locations shown on the Contract Plans.

206.2 PRECONSTRUCTION CONSIDERATIONS

Prior to starting the work for embankment in-place, review the Contract Plans and Specifications, including applicable Supplemental Specifications and Special Provisions. Pay particular attention to the requirements for:

- dredging and environmental permits,
- environmental protection and water pollution control,
- erosion and sediment control,
- limits on the surface area of exposed erodible material,
- borrow pits and haul roads,
- landowner agreements and releases,
- disposal of stripped material from pits, and
- material and equipment.

206.3 INSPECTION DURING CONSTRUCTION

206.3.1 Hydraulic Construction

Check hydraulic construction for conformance with the requirements of the Contract Plans and Specifications. Pay particular attention to the requirements for:

- distance between the pit and the right-of-way line,
- pit approval and reclamation,
- distance material can be excavated or dredged within the toe of the embankment,
- prevention of muck from being trapped within the fill section,
- obtaining original and final cross-sections,
- embankment slopes,
- removal of timber and filling of holes in the embankment,
- prevention of damage to adjacent property, and
- use of excess material to raise the embankment.

206.3.2 Construction Using Hauled-in Material

Check that construction using hauled-in material complies with the requirements of the Contract Plans and Specifications. Pay particular attention to the requirements for:

- embankment elevation with respect to the action of ground water,
- compaction of layers of not less than 95% of maximum density,
- stability of material subject to ground water,
- removal of unstable material,
- obtaining original and final cross-sections, and
- use of glass aggregate material.

206.4 POST-CONSTRUCTION CONSIDERATIONS

No pavement structure will be placed until the underlying embankment work has been tested and approved by the District Construction Engineer.

206.5 DOCUMENTATION AND PAYMENT CONSIDERATIONS

Measure and pay for embankment in-place by volume completed and accepted. Calculate the volume using cross-sectioning, the average end area method or digital terrain method, as applicable. Do not pay separately for embankment material used to replace material excavated beyond the lines and grades shown on the Contract Plans, and do not pay for overhaul. Document field notes and measurements in the Daily Work Report and applicable SCDOT Construction Forms.

Section 207 Overhaul

Overhaul is the hauling of excavated material beyond the free-haul limit from the source of excavation to the embankment or point of disposal. Overhaul is not typical for SCDOT projects. Check the Special Provisions.

The balance points shown on the Contract Plans represent the most economical haul, computed from theoretical shrink/swell factors. As practical, the Contractor should follow the haul as designated in the Contract Plans. The balance points on the Contract Plans may or may not be the balance points representing actual haul on the project.

When actual balances differ from the balance points on the Contract Plans by an appreciable amount, note the actual balance points observed. If excavated material is obtained from borrow or material pits, note the source and the roadway locations on which the material was used. This is especially important when multiple pits are used on a single project. Also note the distance over the shortest practicable route from the material pit to the project.

If final pay quantities deviate significantly from Plan quantities, a mass-haul diagram will be developed. The Resident Construction Engineer will make this determination and retain these records in the project files. The balance points on the mass-haul diagram will be those observed in the field, taking into consideration any cross-haul performed. In preparing the mass-haul diagram, the rising line will indicate an excess of excavation over embankment and a declining line will indicate a surplus of embankment over excavation after the shrinkage factor has been applied.

Section 208 Subgrade

208.1 DESCRIPTION OF WORK

The subgrade is the top 18" of the roadbed upon which the base structure and shoulders will be constructed. The Resident Construction Engineer and SCDOT Inspectors will be responsible for inspecting the subgrade with respect to materials, grade, width, thickness, cross slope, density and drainage. It is good construction practice to continually monitor the subgrade for excessively wet areas, high or low spots, ruts, muck and loose or segregated materials. Require that such unsuitable soil material be removed and replaced with acceptable material and properly compacted. Underdrains or rework (e.g., additional grading and compaction) may be required. The subgrade must be approved by the District Construction Engineer prior to constructing the base structure (e.g., subbase, base courses).

208.2 PRECONSTRUCTION CONSIDERATIONS

208.2.1 Contract Document Review

Prior to subgrade construction, review the Contract Plans and Specifications for any special requirements. Pay particular attention to the requirements for erosion and sediment control. All earthwork within the project section must be substantially completed and drainage structures must be completed and backfilled prior to work on the subgrade.

208.2.2 Sampling and Testing Considerations

It is the Contractor's responsibility to obtain the required subgrade density by any means desired. The material's actual dry density will be determined using SC-T-30, SC-T-31, SC-T-32 or SC-T-33, as appropriate. The maximum dry density and the optimum moisture content will be determined using either the One-Point Proctor Method (SC-T-29) or the field method of determining moisture-density relationship (SC-T-25). The frequency of density testing must be performed in accordance with the minimum criteria presented in Section 106, but should be increased, as needed, to closely monitor compaction, such as in areas where changes are noted in soil conditions (e.g., color, texture). This is especially important as the material is placed and compacted near subgrade elevation. Either SC-T-29 or SC-T-25 should be performed each time a change in soil condition is noted. Even if the soil remains fairly uniform during placement and compaction, it will still be necessary to obtain samples every 1000 feet to the depth indicated in the Special Provisions. Use previous experience and sound engineering judgment to assess the need for additional testing. In addition, if the Special Provisions require the top portion of the subgrade material to be a certain AASHTO or ASTM classification, subgrade samples will be obtained in both fill and cut sections. See Appendix C for SCDOT Sampling and Testing Procedures.

Submit subgrade material samples to the Research and Materials Laboratory for testing. It is critical to submit these samples promptly during the work so that poor subgrade material can be removed and replaced during the grading operation. Sometimes poor material is obvious, but other times it is not. Include on the Sample Identification Card (see Appendix B) the survey station number, distance from centerline and whether the sample is from a cut or fill section. Specifically note if the sample was obtained at subgrade elevation. If the Test Report from the Research and Materials Laboratory indicates that the sample failed and a check sample is requested, obtain and forward to the Research and Materials Laboratory the required check samples representing the failing material. Check samples are discussed in Section 106. In general, Test Reports on samples from cut sections are to assist the Resident Construction Engineer in assessing the suitability of the material.

Maintain a full record of density tests and test results in the project files. The Resident Construction Engineer should retain SCDOT Form 200.02 – Percent Compaction by Nuclear Gauge or SCDOT Form 200.03 – Percent Compaction by Nuclear Gauge – Direct Read Gauge; however, SCDOT Form 200.01 – Field Density Test Report (Nuclear Gauge) must be sent to the Research and Materials Laboratory on a weekly basis. Report the location of each density test, including the survey station number, distance from centerline and whether the sample is from a cut or fill section. Specifically note if the sample was obtained at subgrade elevation.

208.3 INSPECTION DURING CONSTRUCTION

Every effort should be made to provide a firm, uniform subgrade that will minimize differential settlement. Such settlement will eventually develop under the wheel paths of vehicular traffic. Soft, unstable material must be removed and replaced with suitable material. Such material will cause irregularities to be reflected in the final surface course. The subgrade on top of an embankment must be constructed of the best economically available material. Inform the Contractor of the material that is best suited for this purpose and ensure that it is properly placed and compacted. Continually check compliance of the cross-section of the subgrade using a hand level, engineer's level, or by other suitable means. The Contractor should not be permitted to place the base structure on a subgrade until its density, cross-section and grade have been approved by District Construction Engineer.

Compaction enhances subgrade bearing capacity and performance by reducing shrinkage, swelling and permeability. Verify that the subgrade is compacted to a minimum 95% of maximum density. The Contractor is responsible for obtaining this density by any means desired. Pneumatic-tire rollers are often used for this purpose. Density testing should be performed as discussed in Section 208.2.2. It is critical to perform density testing just prior to placing the base structure, because the subgrade will lose its compaction if exposed for any length of time to weather.

208.4 POST-CONSTRUCTION CONSIDERATIONS

Verify that the subgrade is finished to a smooth and compacted condition with a surface that is free from ruts and depressions and of the proper grade and cross-section. The District Construction Engineer must approve the subgrade prior to further work.

208.5 DOCUMENTATION AND PAYMENT CONSIDERATIONS

Work and materials for subgrade will not be measured and paid for separately. Do not pay the Contractor any additional compensation for filling holes, ruts or depressions that develop in the subgrade or for bringing the surface to line and grade. Document all field notes in the Daily Work Report and appropriate SCDOT Construction Forms.

Section 209

Shoulders and Slopes

209.1 DESCRIPTION OF WORK

The Resident Construction Engineer and SCDOT Inspectors will be responsible for ensuring that shoulders and slopes are constructed in accordance with the requirements of the Contract Plans and Specifications. The work generally involves excavating, hauling, placing, compacting and maintaining approved select material. Where the shoulders are not constructed to the required cross-section, require the Contractor to correct any portions that are not within reasonable conformity with the Contract Plans.

209.2 PRECONSTRUCTION CONSIDERATIONS

Prior to construction of shoulders and slopes, pay particular attention to the requirements for:

- environmental permits and water pollution control;
- erosion and sediment control;
- limits on the surface area of exposed erodible material;
- material pits and haul roads and their reclamation;
- landowner agreements and releases;
- disposal of stripped material from pits;
- material and equipment;
- salvage and reuse of material (e.g., stockpiles, select excavation material); and
- original and final cross-sectioning.

209.3 INSPECTION DURING CONSTRUCTION

Verify that the select material for construction of shoulders and slopes is capable of growing grass. Know the requirements for sequencing the shaping, trimming and compaction operations and the timing, placement and compaction of the material with respect to the type of roadway being constructed. All construction should be performed in a manner that will promote drainage without erosion. Verify the proper densification of the material.

209.4 POST-CONSTRUCTION CONSIDERATIONS

All work related to shoulders and slopes must receive final approval from the Resident Construction Engineer prior to any other work proceeding at the site. Verify that the Contractor properly maintains shoulders and slopes during subsequent operations.

209.5 DOCUMENTATION AND PAYMENT CONSIDERATIONS

The select material that will be placed on shoulders and slopes will be measured and paid for on a unit volume basis, as specified in the Contract. If no separate pay item is specified in the Contract, the material will be paid for as unclassified excavation. Discuss with the Resident Construction Engineer the method that should be used to obtain the volumetric measurements (e.g., cross-sectioning, load counts). Document measurements and field notes in the Daily Work Report and appropriate SCDOT Construction Forms.

Section 210

Flowable Fill

210.1 DESCRIPTION OF WORK

Flowable fill is a controlled low-strength material that can be placed in a self-leveling consistency or in a less flowable state to reduce the fluid pressure exerted by the material. Where flowable fill is used, the Resident Construction Engineer and SCDOT Inspectors will be responsible for ensuring compliance with respect to application, materials, proportioning, handling, maintenance and protection of the work.

210.2 PRECONSTRUCTION CONSIDERATIONS

Verify that the type of mix to be used (e.g., Mix 1 (less flowable), Mix 2 (very flowable)) is appropriate for the project application. The foaming agent used must be supplied from a manufacturer listed on SCDOT Approval Sheet 31. Check compliance of the equipment used to produce, transport and place the flowable fill.

210.3 INSPECTION DURING CONSTRUCTION

Ensure that the Contractor is taking precautions to prevent pipes from floating out of position due to the buoyancy of the flowable fill mix. The buoyancy is greater with the more flowable mixtures. Check cover for compliance. The minimum cover of flowable fill over pipes, utilities, etc., is 6 inches. Ensure that bleed water is being adequately drained. Ensure that backfilling of pipes is being distributed evenly to equalize the pressure on both sides of the pipe and to prevent movement. If it is necessary to resume traffic before the flowable fill has hardened sufficiently, verify that the Contractor has provided steel plates to bridge over the patched areas.

210.4 POST-CONSTRUCTION CONSIDERATIONS

Assessing the acceptability of the work and materials and final approval of the work is the responsibility of the Resident Construction Engineer.

210.5 DOCUMENTATION AND PAYMENT CONSIDERATIONS

Measure and pay for flowable fill based on the volume delivered to the job site, incorporated into the work and accepted by the Resident Construction Engineer. Note that where Mix 2 (very flowable) has been used, the volumetric difference due to the additional water will be neglected. Document measurements and field notes in the Daily Work Report and appropriate SCDOT Construction Forms.

