205.00 EXCAVATION *(SSHC Section 205)*

205.01 DESCRIPTION

The importance of being able to identify soil types cannot be overemphasized. Some soil types have to be placed in the proper location. The inspector must be sure that the work is performed according to the plans.

The balance factor is the change in quantity from cut to fill and includes subsidence, change from borrow density to the final compacted density, incidental loss, and all other factors changing density.

205.02 MATERIAL REQUIREMENTS

Embankment and Excavation Soils Criteria *(SSHC Section 206)*

There are four basic categories of earthwork.

- Excavation
  - ♦ Usually final cross sections determine pay quantity.
  - ♦ No off-site borrow is required.
- Excavation (Established Quantity)
  - ♦ Payment is based on the plan quantities.
  - ♦ No off-site borrow is required.
- Excavation Borrow
  - ♦ Usually final cross sections determine pay quantities.
  - ♦ Borrow will be needed from off-site source(s).
- Earthwork-Measured-in-Embankment *(SSHC Subsections 205.04/205.05)*
  - ♦ Plan quantities of the proposed embankment are used to determine the payment quantity.
  - ♦ Contractor must forecast shrinkage. (A change from borrow density to compacted density.)
  - ♦ Borrow from off-site sources.

"Excavation" and "Excavation Borrow" are paid based on final cross sections. The Project Manager may forego the final cross sections when the contractor agrees, in writing, that the plan quantities, including field adjustments and revisions, accurately reflect the work done. Payment will be made under the original contract items. It is not necessary to eliminate the original contract item and establish a new “E. Q.” item. Refer to Page 129.

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The Project Manager and the contractor may elect to measure areas in question and accept the remaining areas as "Established Quantities."

Unsuitably Wet Material

In low-lying areas and in wet soil contact zones, it may be necessary to declare most of the material as unsuitably wet at the direction of the Project Manager. A granular material that will drain can be used to replace the wet soil. An effort should be made to provide an outlet for water which may occur in the embankment or subgrade. Most wet soils that are removed can be dried and reused in some other area.

Soft shale, in some cases, can be moved in a manner similar to soil excavation. Shale cuts are usually benched and covered with topsoil in accordance with the plans. If unexpected shale is found, contact the Materials and Research Soil Mechanics Engineer. Slides can occur in backslopes of shale cuts, and flatter slopes may be required.

Rock Material (See *SSHC Subsection 107.08 and Section 206*)

If material to be excavated is too tough to be ripped, the Project Manager, contractor and a geotechnical specialist experienced in blasting should discuss the aspects of the work to be done.

Contractor Furnished Borrow Areas *(SSHC Subsection 205.03)*

On some projects, the contract documents will require a "contractor borrow." In these cases, the contractor is responsible for submitting a site approval request to the Construction Division (allow 60 calendar days for the Construction Division to obtain site approval from Nebraska agencies).

Construction Engineer
Nebraska Department of Roads
1500 Highway 2
P.O. Box 94759
Lincoln, Nebraska 68509-4759
Fax No. (402) 479-4854

The approval request shall include:

- A Borrow Pit/Materials Pit Identification and Evaluation Form for each site.
- An aerial photo or topographical map showing the location of the pit site (one photo or map for each site).

No material will be removed from the site prior to the Project Manager's written approval of the sites.

The contractor shall also obtain a Corps of Engineers approval letter for the site and submit this to the Project Manager. The contractor shall submit a topographical map or a photocopy of an ASCS aerial photograph showing the exact location of the proposed pit sites to the Corps of Engineers. A legal description of the location should also be included.

Corps of Engineers
Regulatory Branch
P.O. Box 5
Omaha, NE 68101-0005

ASCS aerial photos are available at county ASCS offices at a nominal cost. ASCS aerial photos cover agricultural ground only. In some instances, aerial photos or urban areas are not available from the ASCS.

Topographic maps may be obtained from the following source:

University of Nebraska
Conservation & Survey Division
113 Nebraska Hall
Lincoln, NE 68588-0517
Attn: Judy Otteman
(402) 472-7523

Approval For Soil Type (Contractor furnished borrow)

- The Contractor will obtain soil samples to verify material is acceptable. The Project Manager will forward the samples to the Materials & Tests Office for evaluation. (See *SSHC Subsection 205.02.*)

Preservation of Cultural Resources *(SSHC Subsections 205.03 and 107.10)*

Cultural resources are the composite of archaeological and historic/architectural resources in an area. A common cultural resource site is a burial ground or remains of a Native American village.

Nebraska law requires action be taken to insure that cultural resources are not damaged or destroyed.

If a cultural site is discovered during construction, the contractor is required to temporarily discontinue work at the site. Upon discovering such a site, the Project Manager shall notify the Construction Office of the finding.

Nebraska Game and Parks Commission Approval of Borrow Sites

- All Contractor borrow sites must be submitted to the Nebraska Game and Parks Commission (NGPC) for approval. The NGPC will examine the proposed site for endangered plant and wildlife species and for potential Platte River drainage system depletion. This process can take 60 days or more.

Borrow Pit/Materials Pit Identification and Evaluation

Project No.:	Date: / Control No.:
Project Location:	County(s):
Requesting Contractor:	Phone:

Pit Size and Location

1. Pit Identification No.: _____
2. Identify the precise location of the pit *(to 2.5 acres):*

   _____ ¼, of _____ ¼, of _____ ¼, of _____ ¼, of Section _____, T- _____ -N, R- _____ - _____

3. Attach a copy of an ASCS aerial photo and/or a copy of an USGS 1:24,000 scale topographic map precisely depicting the pit location.
4. Give pit dimensions *(in feet)* and orientation *(NE-SW, etc.)* for long axis *(length),* short axis *(width)* and depth.

   Length: Feet: _____ Orientation: _____

   Width: Feet: _____ Orientation: _____

   Depth: Feet: _____
5. This is a: ☐ Dry Pit ☐ Wet Pit
6. Will this pit pond water when completed? ☐ Yes ☐ No
7. Pit location is owned by: ☐ Private Owner ☐ Commercial/Business ☐ State/County/City Government ☐ Federal Government
8. Name of Owner: _____

Pit Characteristics

1. Pit location is for: ☐ Borrow ☐ Material ☐ Both ☐ Other *(Explain)*
2. To your knowledge, has this pit location been used previously for borrow and/or materials? ☐ Yes ☐ No ☐ Unknown
3. The pit location is presently used for:
   - ☐ Commercial Borrow/Materials
   - ☐ Pasture
   - ☐ Row-Crop Agriculture
   - ☐ Stock Pond
   - ☐ Irrigation Recharge Pit
   - ☐ Urban/Suburban Residential
   - ☐ Stockpiled Borrow/Material
   - ☐ Other *(Explain)*
4. Vegetation cover is: ☐ Grass ☐ Trees ☐ Weeds ☐ Crops ☐ Other *(Explain)*
5. Name, address, phone number of contact person, if additional information is required:

Contractors requesting use of borrow or materials pits for Nebraska Department of Roads' construction projects need to identify their location and character on this form. Please fill in the blanks with the correct information or select appropriate answers to questions. ***Send the completed form to the Construction Division, Nebraska Department of Roads, PO Box 94759, Lincoln NE 68509-4759 or FAX to (402) 479-4854.***

Approval Block – For State Use Only

Nebraska State Historical Society	Nebraska Game and Parks Commission
Date received from the contractor: _____	Date received from the contractor: _____
Date submitted to NSHS: _____	Date submitted to NGPC: _____
Return due date: _____	Return due date: _____
Approval date: _____	Approval date: _____
Non-approval date: _____	Non-approval date: _____
Signature: _____	Signature: _____

DR Form 119, Feb 01/

Figure 204.01

205.03 EQUIPMENT *(SSHC Subsection 206.03, Paragraph 9.a.)*

- Equipment should be sufficient to meet compaction requirements and the type of equipment used should be recorded in the field book.

Overweight Axle Loads *(SSHC Subsection 105.11)*

All oversize hauling units delivering equipment or materials to the project shall be legal loads and/or have appropriate hauling permits issued by the Motor Carrier Permit Office. The State Patrol Carrier Enforcement Division has enforcement authority outside of the project limits and on those portions of the construction project maintained to through traffic.

Hauling On or Over Surfaced Roads

The contractor must protect from damage all public roads that will be used by the contractor. Usually berms (greater than 300 mm (12 inches) thick) are constructed over the road surface for the earth moving equipment to use.

Certified flaggers are required when the berm is on an active road.

The berm must be removed from the road and shoulders at the end of each day when the road is active and the surface area cleaned.

The berm must be maintained constantly by the contractor. This will allow safe traffic flow over the berm.

205.04 CONSTRUCTION METHODS

Embankment Construction *(SSHC Section 205)*

The construction of embankments is covered in *SSHC Section 205*. This Subsection provides a more detailed picture of certain procedures mentioned in the *Specifications*. These comments should be regarded as explanatory but in no way supersede or invalidate Specification requirements.

Site Preparation

All trees, shrubs, cornstalks, sod, and other vegetation are to be removed and disposed of according to *SSHC Section 202*. After cornstalks and tall grass are cut and removed, the area within the limits of construction is to be thoroughly disced and scarified.

Deposition of Embankment Material *(SSHC Subsection 205.03)*

On projects where a slope is being widened, "benching" will be required.

Hauling units should be directed over a fill so that uniform compaction will result.

The self-propelled tamping type roller may be used on the embankment area for leveling as long as the unit follows the prescribed rolling pattern, does not spin the power drums, and accomplishes both rolling and leveling to the satisfaction of the Project Manager.

Decisions and unusual situations should be recorded in the field book.

Compaction

Embankments shall be compacted as prescribed in *SSHC Subsection 206.03*.

Class I embankments are to be rolled when specified by special provisions or plans; no moisture-density tests required.

Class II embankments require rolling; no moisture-density tests required.

Class III embankments require moisture-density control. The moisture content of soils being handled for these embankments is very important because the objective is to stabilize soils and improve their engineering behavior by compaction. Maintaining a soil to near "optimum moisture" during grading operations will reduce the time and compaction effort necessary to obtain the required density.

Note:
- Class I and II embankments require only enough moisture in the soil to attain a compaction acceptable to the Project Manager.
- Class I - no moisture requirement by *Specifications*.
- Class II - drying only required if necessary to obtain compaction.

Moisture control; water acts as a lubricant and helps the soil particles move relative to each other into a denser condition when compaction effort is applied. Dry soils must have water added and be thoroughly mixed before compacting. A general guide would be to add water to silt-clay soils when lab or field tests indicate moisture content is five percent or more below the optimum.

When wet and dry soils are placed in the same lift, they should be disc blended to a uniform condition prior to compaction.

Soft Ground; embankments that cross low wet areas may require an initial stabilization layer which is granular material. Usually the Project Manager will permit a working platform, up to 1.0 m (3 feet) thick, to be placed in one lift when bridging a soft area. Sand, gravel, or well graded crushed rock may be used for this initial lift. Compaction should proceed with caution. In general, the use of vibratory rollers should be discouraged since the vibrations may cause underlying soil to pump into the granular fill. In some areas, capillary action will move moisture into the upper grade by equipment moving on it. Contact Materials & Tests when you encounter this situation and it is not covered in the Plans.

◆ HELPFUL HINTS

Sand embankment directly deposited by dredge pipe will obtain about 95% of NDR T 99 proctor density by the transporting water flowing through the fill. For this method of placing sand, other methods of compaction may be required. Testing should be done at regular intervals and recorded in the field book. The time for this test is just after the free water leaves the top 200 mm (8 inches) of fill and can be done very quickly with a nuclear density gauge.

Sand lifts should be placed the full width of the embankment. If this cannot be done, a sand trench drain should be placed to eliminate ponding water.

If soils are too wet, compactive effort increases the pore water pressure and holds the particles apart. The upper limits on moisture has been set above optimum and recommendations are based on the type of surfacing or embankment designed. (Requirements are shown on the plans and/or in design files).

Wet soils can become elastic and result in heaving or pumping of the embankment when loads are applied. This is caused by water pore pressure and the strength of the soil is substantially reduced. If the embankment has not been damaged, equipment should stay off of the area long enough to allow excess pore pressures to dissipate naturally. If loading were to continue on wet soil, it may have shear failure or rutting. The Project Manager should explain to the contractor that continued operations can only worsen the situation and require removal. Take a moisture measurement to show the contractor that the soils moisture content is rising and to document that the contractor is damaging the soil.

The contractor should be encouraged to route hauling equipment as evenly as possible over the entire surface area of the embankment during soil placement. This will reduce possible rutting or damage caused by heavy equipment following one path.

The nuclear gauge for moisture and density determination may be used. Only properly trained and qualified nuclear gauge operators can use a nuclear gauge.

Nuclear gauges are to be operated according to NDR T 238, AASHTO T 238 and ASTM D 2922. Test results are distributed according to the instructions on the test form. This form may be used without field book entries.

Use the nuclear gauges printout as the official project record.

Moisture Density Curves

When a grading inspector is not sure which moisture density curve to use, he/she should review the available soils information at the location in question. If it is determined that there is not a moisture density curve to represent the soil in question, then a 1-point moisture density curve may be run in the field according to NDR T 505. Only use the 1-point curve method until Materials & Tests can determine the complete curve data for the soil.

During compaction, the mold shall rest on a firm surface such as concrete box culverts, bridges, and pavements.

Construction of Embankment Toe Berms

If the plans require a berm, it should be constructed at the same time as the embankment.

Toe berms are built in areas where the roadway is used as a dam for a pond. In these areas the berm is used to protect the embankment from saturation by the standing water. Also to help construct fills on unstable ground. Proper compaction and soil types are needed to reduce permeability of the fill.

Construction of Bridge Approach Fills

Toe stakes should be set and the slopes and the centerline checked during the construction of the embankment. The slopes should be finished to the lines and grade called for in the plans.

In the construction of these berms, particular attention should be given to prevent the incorporation of rocks over 100 mm (4 inches) in diameter as the lifts are placed. Rocks cause extreme difficulty when driving piling or preboring for piling.

The removal of boulders greater than 1 m (3 feet) in diameter in bridge berms should be covered as "extra work".

Bridge approach fills should be constructed to grade with adequate length along the centerline for the bridge contractor to work. This length should be adequate for the bridge contractor's storage of material. Usually 30 to 45 m (100 to 150 feet) are adequate. This can be shortened by mutual agreement between the contractors.

On some projects settlement plates are required along with delay periods for abutment construction. The settlement plate readings are sent to Materials & Tests for comparison with the design settlement predictions. In cases where the settlement differential is minimal (near the end of the delay period), the delay period may be reduced with Materials & Tests approval.

Earthwork-Measured-in-Embankment

Payment for embankment in place will be based on the plan quantity.

Sections of deep fills may have the quantities adjusted, based on settlement plates. These settlement plates should be well protected to insure that they are not damaged or destroyed.

A graph may be plotted with fill height vs. settlement to determine settlement at intermediate heights of fill. Using this chart, the settlement below the original ground line can be determined and plotted. The volume between the plotted settlement line and original ground can then be calculated using the average end cross section method. This volume is added to the plan quantity for final payment.

Prewatering Plan

The contractor shall present a prewatering plan at the pre-construction conference when prewatering is required. The plan should be approved by the Project Manager.

Payment for Water for Embankment Construction

When water is required for compaction of embankments other than Class III, it should be paid for as extra work if no contract item has been provided.

When water is required for moisture and density control, the cost of adding and incorporating water is a part of the item.

Finishing

Finish grading must be completed on a timely basis so that erosion control measures may progress satisfactorily. Special provisions on many projects limit the surface area that the contractor may disturb. Generally, this area is 75,000 m² (90,000 square yards), excluding areas to be paved, plus an equal amount of clearing and grubbing area may be opened up. The Project Manager may increase these limits but only by written notice to the contractor. If used, this written notice should include justification for the increase and special procedures the contractor must use to safeguard the environment. Copies of this notice must be forwarded to the Construction Engineer and the District Engineer. 75,000 m² (90,000 square yards) is equal to approximately 1.6 km (1 mile) on an average two-lane, full grading project. Any repair required on sections that have been tentatively accepted will be considered extra work (unless considered to be the fault of the contractor) and if performed by the contractor they are entitled to additional pay as provided for in *SSHC Subsection 109.05*. Therefore, final cross sections may be taken on a section of grading after it is tentatively accepted per *SSHC Subsection 105.13*.

If the finishing work is not performed on a timely schedule, the Project Manager is advised to follow these progressive steps:

- Project Manager should notify the contractor of the concerns in writing.
- If this does not obtain results, suspend estimate payments.

Tentative Acceptance

Areas that have been final graded may be accepted by the Department. However, do not accept an area until silt fence, cover crop, erosion checks, and other erosion control measures are in-place. Do not tentatively accept areas where the contractor must operate equipment to do other requirements. For example, shoulders and foreslopes should not be accepted until pavement and shoulders are finished. Ditch bottoms are a questionable area for tentative acceptance. Often, the Contractor plans to use material in the roadside ditch bottom to build the shoulder. In these cases, do not tentatively accept the ditch bottom until the shoulder work is also complete.