# SECTION 201.00 -- EARTHWORK INSPECTION CHECKLIST

EMBANKMENTS/EXCAVATION

*SSHC References:*

*Section 205 Excavation & Embankment*
*Section 1033 Aggregates*

Other References:

NDR, Materials & Tests, Earthwork Engineering Guide
NDR Materials and Sampling Guide
NDR Standard Test Methods

Inspection Crew:

Grade Inspector

Inspection Equipment:
(AASHTO T 238)

Nuclear Density Gauge (With Manual)
Nuclear Density Gauge probe puller or auger.
Thermometer (Surface)
Scale (Dept. of Ag. Certified)
Metal Thickness Ruler
3 m (10 foot) straightedge
Gravel Sampling Bags

Equipment
(NDR T 205)

Spade.
Rubber Balloon (flexible membrane)
Sand.
Calibrated container with an air valve and a volume indicator.
Base plate.

Embankment/Excavation Procedures:

General Comments:

1. The operations of excavating the roadway and borrow material (Roadway Excavation) and the placing, compacting and finishing of the excavation material in the embankments or fills (Embankment) are inspected and controlled as a single "Grading operation".
2. The value of grading may be considerable.
3. "No building is better than its foundation" and good quality embankments and subgrade are essential to the good performance and quality of the base course and pavement structure.
4. The grade inspector's work is of the utmost importance in producing a quality riding surface for the motorist.

5. The large and fast grading equipment employed by grading contractors means inspector should be on site to sample each lift.
6. The inspector should be thoroughly familiar with *SSHC Section 205 Excavation and Embankment*.
7. Check all contract documents for grading requirements.
8. The type of embankment compaction will be specified in the plans (generally on Sheet No. 3).
9. Construction notes in the plans should be noted and checked against physical features on the project. The right of way should be checked for physical features and obstructions which may not be shown in the plans. Typical items to be checked:
   a. Check the construction widths needed, and fences which must be moved, and compare them with the available right of way and contracts for additional right of way, borrow and construction easements.
   b. Utility pole lines - check against construction limits and utility agreement provisions.

See Subsection 1300.03

   c. Survey or other type monuments or markers - mark or relocate.
   d. Selective placement notes.
   e. Trees or shrubs which are indicated in the plans to be preserved -mark as necessary.
   f. The Design file contains all of the preliminary and design information of the soils, pit sketches and contracts, preliminary soil compaction curves and soil tests.
10. Rights of adjacent property owners will be protected.
   a. Tile lines and intakes should be located, replaced, and repaired to maintain the integrity of the subsurface drainage. (Preventing unintended drainage from reaching adjacent property.)
   b. Right-of-way contracts should be checked for possible special negotiated items which should be included in the work being done.
11. Any contractor operation that causes damage to partially completed or completed work shall be reported to the Project Manager and noted in the Daily Diary.
12. Make sure the contractor installs silt fences prior to commencing soil disturbing work.

Preconstruction Conf:

1-800-331-5666

13. Preconstruction Conference (See Subsection 102.01)
    a. The Project Manager should go over the unusual, difficult, or special items with the grading inspector, and with the contractor.
    b. Remind the Contractor to call "1 CALL - Diggers Hotline of Nebraska", for buried utilities, pipe lines, sewers, communication cables, etc. - check for possibility of such not being shown and be sure provisions are made to mark or protect as necessary to prevent damage.
    c. Inspection and Control of Grading Operations
    d. The contractor's Pre-Watering Plan should be presented and discussed.
    e. Discuss selective placement requirements.
    f. Determine what contractor will do to keep stockpiles free from contamination.
    g. Removal and storage of topsoil materials, shall be discussed.
    h. Project schedule. *(SSHC Subsection 108.07)*
    i. Partnering procedures.
    j. Traffic control.
    k. Archeological & palentological discoveries.
    l. Environmental issues(Erosion Control, Wet Lands, Migratory Bird Nesting)
    m. Detours and Shooflies.
    n. Railroad Special Provisions.
    o. Safety issues (Guardrail removal, etc.)
    p. Material submittals.
14. Site preparation such as clearing and grubbing, wetlands preparation, removals, and vegetation disposal on cuts, fills, and borrows are accomplished according to contract documents.

Stockpiling:

15. If stockpiling of selective placement material is necessary, <u>no payment</u> is made for re-excavation. (Topsoil, sand, or any soil identified as select materials.)

Clearing & Grubbing:
A large tree has 1 m (3 foot) circumference at 1 m (3 foot) above ground line or if only the stump remains, a stump of 1 m (3 foot) circumference at ground level.

16. If contract has "Large Tree Removal" count and record trees before work starts.
17. *SSHC Subsection 204.02* limits the surface area that the contractor may disturb to 75,000 m² (90,000 square yards) plus an equal amount of clearing and grubbing area.
18. The Project Manager may increase these limits but only by written notice to the contractor.
19. The written notice should include justification

for the increase and special procedures the contractor must use to safeguard the environment.

20. Copies of this notice must be forwarded to the Construction Engineer and the District Engineer.
21. 75,000 m² (90,000 square yards) is equal to approximately 1.6 km (1 mile) on an average project.

Soil Moisture:

22. Check the moisture content of the excavation and borrow material 1-5 days before the contractor starts work.
23. Discuss the drying or moistening of the excavated material.
24. Check to see if contractor knows the condition of the soil.
25. Verify how the contractor will control moisture in Class "III" embankments
26. Contractor should mix clay/non-granular material to uniformly distribute the moisture and various soil types before compaction.
27. Pre-Watering can be wasteful. Ponding or sprinkling may require more water and more work than wetting the soil as it is placed.
    a. But the moisture content will be more uniform and dust will be eliminated.
    b. The contractor is responsible to obtain the soil samples both before and during the water application.
    c. The Project Manager will run moisture tests to determine water application rates and to check the progress of the penetration. Use nuclear density gauge to determine the moisture content at different elevations below the surface up to depth of cut. Compare the amount of prewater to the expected amount that would be required if added at time soil is placed.
    d. The following example does not allow for water lost by evaporation, run off, etc., and will need to be supplemented by information derived from subsequent testing.
    e. As a precautionary measure against overwatering, leave some dry material for mixing with soil which was over watered. (Required water per cubic meter) (cubic yard) - (Natural in place water in the soil per cubic meter) (cubic yard) = Amount of water to add or if negative result, the amount of water to remove per cubic meter (cubic yard).
    f. Preserve the natural vegetation on the area until the watering is complete.

g. If the vegetation is removed before watering, or the soil type, slope, or condition warrants, the ground should be ripped 650 mm (2 feet) deep on its contours approximately 1.2 m (4 feet) centers to allow penetration of water and minimize runoff.
h. Adjust the application rate to control runoff and erosion.
i. Construct dikes to control runoff and erosion.
j. Document any wasted water in field book.

28. Excavation areas should be disced immediately after pre-watering to reduce evaporation.
    a. A two to three week curing period is necessary to permit the water to move downward and become uniformly distributed in the soil.
    b. The importance and length of this curing period will vary with the soil type and conditions of the soil. (Clay very important--sand not important.)

Compaction:
(See *SSHC Subsection 206.03 para 9*)

29. Compacting equipment which produces a glossy surface shall not be allowed. This may cause lamination.
30. PM should approve all haul routes over structures.
31. Know the moisture/density requirements for each section of the project.
    a. Review *SSHC Subsection 205.03* for construction methods and procedures which give moisture, density, and lift thickness requirements.
32. a. A good practice is for the contractor to spread the soil as thinly and smoothly as practicable, to distribute the hauling equipment over the embankment to minimize the rolling.
    b. Discing is required to get uniform density.
    c. Layers must be compacted before the next layer is placed.
33. Require rolling over entire area--completely to the outside edges.
34. Require that hauling and leveling equipment is routed over the full width of the embankment.
35. Visually check the subgrade and the embankment under compacting equipment.
    a. When a sheepsfoot walks out of soil you have good compaction.
    b. Peorian clays may show movement/instability and yet be at specified density. (When this occurs, additional work is necessary to stabilize the fill.)
36. a. Compare earthwork to the stakes--tell the Project Manager and the contractor if something does not look right.

b. Make sure stakes are uniform and easily read.

37. Run one-point curves for soils that do not have corresponding compaction curves.

Subsurface Concerns:

38. Insist that all objectionable material such as logs, vegetation, trash, or unsuitable soils are removed before fill is started.

39. a. Require old pavements to be removed if embankment will not be greater than 1 m (3 feet). If more than 1 m (3 feet) of embankment the pavement must be broken-up.

b. *SSHC Subsection 104.06* defines "minor obstruction" and lists examples of when the contractor should be paid extra for removal of unforeseen obstructions.

Drainage:

40. The roadbed will be adequately drained and protected at all times. (Poor drainage during construction often results in an inferior construction.)

a. The roadbed should be tight (shaped, bladed smooth, and rolled, so as to shed water) at the end of each day.

b. Flowable fill, granular fill, drain pipes, or other requirements may be necessary to permanently correct the problem.

Settlement:

41. Things to check:

a. Settlement or side slip may result in slopes or sidehills if not properly stepped or plowed.

42. Settlement may result at Grade points (0-0 sections) due to fill taper, improper or insufficient compaction and different soil type (Subsoil - topsoil - parent soil) meeting. Particular attention should be given to the compaction of the new embankment at 0-0 points. Usually blending to 1 m (3 feet) depth is required.

43. Settlement of areas adjacent to or over structures frequently occurs. Take additional density readings in these areas.

a. Proper placement and compaction of material in the areas inaccessible to rollers and the earth moving equipment will eliminate this problem.

b. This involves close contact inspection of compaction performed by small mechanical tampers, which is tiresome, manual work.

c. The inspectors' must confirm that this work is properly performed.

d. When the slope is greater than 1-vertical to 4-horizontal, step the ground to prevent wedging action against the structure.
e. Use selected soil which will compact readily, if available.
f. Silty soil should not be used.
g. During backfill operations, displacement of wing or abutment walls may be checked by erecting a "telltale" before backfilling is started and checking the wall for movement as the backfill progresses. If movement is detected, backfill operations should be suspended and the Project Manager advised of the problem.

44. Watch for and report unstable and unanticipated settlement to the Project Manager and Materials & Tests Engineer.
a. Bulging at the toe of the slope.
b. Cracks running parallel to centerline are indicators of unstable embankment conditions.
c. Subsidence at bridge ends, excessive cracking inside box culverts or unanticipated swales are signs of excessive settlement.
d. Pumping action.

Foundation Engineer (479-4678)

45. Where surcharges are included in the plans as work to be accomplished during construction, the Soil Mechanics Section of the Materials and Research Division wishes to be informed before the beginning of the construction of the surcharge.
a. Construction progress and anticipated paving date may allow a change in the height of the surcharge necessary to complete the anticipated settlement.

Backfill:

46a. Confirm culvert backfill material meets specification requirements.

46b. Backfills on box and pipe culverts should be brought up evenly on both sides at the same time to avoid displacement of the structure.

47. When tamping under the lowest 90° of a culvert place elevation check stakes at the ends of the pipe to detect any rise.

48. The grade inspector should be alert to possible damage to any drainage structures which the contractor's heavy equipment may cause by crossing or working over such structures, and particularly to possible damage to pipe culverts covered with minimum fill.

a. The contractor shall be informed immediately of any observed damage and the information recorded in the field book.

Grades, Lines & Profile:

49. Large shortages or overages of excavation material may be encountered.
   a. Revising the grade lines, rebalancing, or obtaining additional material outside construction limits or balance points require prior District approval.
   b. The Project Manager should be contacted on all overage or shortage conditions.

50. The grade inspector should inspect and advise the Contractor of deviations from the lines and grades as staked by the Project Manager.

51. The inspector should note any actual construction balance points in the grading notebook.

See Survey Blue Tops

52. Finish grading
   a. The roadbed surface should be finished within 15 mm (5/8 inch) of the finish grade stakes.
   b. The shoulder lines and slopes should be reasonably true.
   c. Side ditches and borrow areas should be finished reasonably true to grade and should drain.
   d. Finish grade stakes should be set for finishing flow line grades in borrow pits if the width and grade are such that stakes are essential to finishing the pit to provide proper drainage without ponding.
   e. Finish grading must be completed on a timely basis so that erosion control measures may progress satisfactorily.

Covercrop Seeding:
(Agronomist Dick Gray 479-4537)

53. All finished work and any other areas that need erosion control should be kept current with covercrop seeding performed as the work progresses.

54. Any repair required on a section that has been tentatively accepted will be paid as extra work (unless considered to be the fault of the contractor). (*SSHC Subsections 105.13, 107.14* and 1*09.08* define tentative acceptance.)

Soil Tests:
(Form DR 86)

55. The inspector should require the contractor to move the field lab as necessary to facilitate the field testing.

56. The grade inspector will test soil samples for two primary purposes.
    a. To monitor the effectiveness of the contractor's operations and use of forces and equipment in controlling the moisture and the compaction of the soil. These are called "job control tests".
    b. To verify that the completed work (compacted embankment) meets the requirements for moisture (if specified) and density. These are called "acceptance tests".

    The minimum number of tests necessary to verify that the compacted embankment meets the specified requirements for moisture and density will be shown in the *Materials Sampling Guide*.

57. The number of moisture-density tests will vary but the minimum is spelled out in the *Materials Sampling Guide*. However, the inspector is encouraged to take additional tests as are necessary because with the nuclear density gauge, moisture and density are easily monitored. "Job control tests" which indicate the need for additional work to meet moisture-density requirements shall not be counted in the "acceptance tests" since a check test would be required in the area represented by the original sample.

Grading Diary:

58. Grading diary, shall include:
    a. Date, weather, soil conditions.
    b. Information on contractor's forces -include numbers of personnel, numbers, types, and sizes of equipment, hours worked each day.
    c. Data on work in progress -section of the project, balance limit, channels, dikes, rough grading or finish grading, etc. This should include a record of known construction balance points, particularly balance points between "off-site" borrow pits.
    d. Weather conditions or other conditions affecting the progress of or delaying prosecution of the work, equipment break downs, etc.
    e. Sufficient records of the progress of the work, to enable the Project Manager to prepare progress reports, working day reports and progress estimates accurately.
    f. Estimates of wasted water, and cause.
    g. Disputes.

h. Contractor's progress should be monitored to check that the work is being completed according to the construction schedule. Report major deviations.

Field Book

59. Field Book Entries

a. Any supporting information or records necessary to facilitate the preparation of the required reports on sampling and testing (see Materials and Research "Earthwork Engineering Guide").
b. Calibration of distributor water tanks and of meter accuracy if the water is metered.
c. Daily record of water hauled (on large projects the water applied may be kept in a separate "water application notebook"). Include location (i.e., station of the excavation, borrow pit, embankment or surface) where water was applied and obtained.
d. Select placement, confirming information, etc.
e. Identify all work performed on the project by the contractor and subcontractor actually completing each pay item.
f. Make entries supporting extra work quantities.
g. Get the contractor representative signature agreeing to pay quantities in the entry.

Measurement:

60. Method of Measurement

a. See CM Subsection 1300.04 for instructions to take cross sections. (Use Geopak when possible.)
b. Measure and pay authorized excavation of material below grade and overbreakage or slides.
c. Unsuitable material which is removed below grade in excavation areas, or below existing ground in embankment areas, is considered to be "authorized excavation of material below grade".
d. If the existing ground in an embankment area must be dried to such a depth as to be impractical to dry in place, the contractor may be ordered to undercut (excavate below grade) and haul this material to higher areas, drying and using it in the construction of embankment.
e. The volume of the undercut would also be considered to be authorized excavation below grade, and the volume measured and paid.
f. Larger quantity under cuts should be authorized by the District Construction Engineer and the volume should be measured by cross sections.

Tell the Contractor what is "larger" at the preconstruction conference.

61. Water, Applied
    a. Distributor truck tanks may be calibrated by determining the mass of both the empty and filled truck. The net mass (kg) (lb) is the tank capacity, in liters (gallons).
    b. Each truck tank should be numbered and the numbers and capacities recorded in the water haul notebook.
    c. Calibration of meters for the pre-watering methods may be accomplished by pumping through the meter into a water truck and checking the mass of water against the liters on the meter.
    d. Meters may be calibrated by registered pump and meter service companies and their calibrations may be used if they are current. Calibrations are good for one year.
    e. Inspector must convert meter readings in English units to S.I. units (metric).
    f. Trucks that are too large to measure their mass on available commercial scales may be calibrated from capacity if model numbers, serial numbers, etc., are the same as shown on the specifications literature.
    g. If the water is measured by tank count, the grade inspector will record each day, the number and size of loads delivered to the project by each truck.
    h. If the quantity of water is measured by a meter, the grade inspector will record the meter readings at the beginning or ending of each day or shift.
62. Calibration
    a. Water meter calibration sheets usually show a correction factor to be used to convert meter volume to actual volume for differing rates of delivery.
    b. The rate of delivery for the application can be determined by timing the meter and computing the liters (gallons) per minute being delivered.
    c. The liters (gallons) per minute delivered will vary with the length of pipe and number of sprinkler heads being used.
    d. Therefore, the delivery rate should be determined and documented for each pipe setup so the correction factor can be determined and used.

63. Wasted Water
    a. The quantities of water wasted or not eligible for payment should be entered in the records each day with substantiating or estimating information to support the quantity deducted or ineligible for payment.
    b. The contractor should be furnished the documented quantities of water wasted each day, to facilitate resolving of any discrepancies in quantities.
    c. The grade inspector is responsible for the proper determination of the quantities of water measured for payment, and each day's entry in the notebook should be validated by his/her signature and agreed to by the contractor and signed.
64. Metering is more practical and economical than a tank measurement.
    a. Encourage the contractor to provide an acceptable meter at the point of loading the trucks to measure the water for payment.
    b. If the water is being applied by the truck sprinkler method, the "Water Applied Haul Sheet" (DR Form 8) may be prepared by the truck driver, and used by the grade inspector to determine the distribution of water applied on various sections of the project, finishing, etc., and for cross-checking quantities.
    c. These sheets are to be used for this purpose only and not for payment, and should not be submitted with the final records.

Critical Construction Requirements:

1. Preconstruction Conference
2. Verify how the contractor will control moisture in Class III" embankments.
3. Visually check subgrade and embankment under compacting equipment.
4. Stability and Settlement Indications. Watch for and report to the Project Manager and Materials & Tests Engineer indications of instability.
    a. Bulging at the toe of the slope.
    b. Cracks running parallel to centerline are indicators of unstable embankment conditions.
    c. Subsidence at bridge ends, excessive cracking inside box culverts or unanticipated swales are signs of excessive settlement.
    d. Pumping action.
5. The roadbed will be adequately drained and protected at all times. Roadbed should be bladed smooth and rolled tight at the end of each day.