

**..... DIVISION OFFICE 1999 INSPECTION IN-DEPTH
Earthwork and Drainage**

Scope of Inspection:

The overall purpose of this inspection is to evaluate project enforcement of established inspection procedures, however; the following items should be considered during the review:

1. Determine whether an existing procedure and/or specification is practical and is capable of being easily understood and implemented by personnel and/or the contractor.
2. Determine whether field personnel have sufficient training, ability, and/or interest to thoroughly understand and enforce existing procedures and/or specifications.

In order to provide the Area Engineer with flexibility in reviewing the problem areas, this guideline is divided into six parts (see below). All or any one of the four parts may be reviewed depending on job conditions and time limitations:

1. Embankment Construction
2. Excavation, Borrow, and Waste
3. Documentation - Excavation and Fill Operations
4. Pipe Installation and Documentation
5. Testing

Photographic slides should be taken as considered desirable to show good and bad construction.

Project Data:

Project No.:
County:
Inspection Made By:
In Company With:
% Work Completed:
% Time Elapsed:
Date of Inspection:

References:

1. 1994 Specifications,
2. July 1, 1998 Supplemental Specifications,
3. Special Provisions,
4. Materials Procedures

A. EMBANKMENT CONSTRUCTION

1. Preparation
 - a. When fills are 1.5 m or less, is the top soil being stripped and the top 200 mm of original ground being properly scarified and compacted?
 - b. Are all existing slopes, other than rock, against which embankments are to be placed being plowed or deeply

scarified to allow blending with the embankment material?

- c. The lower part of embankments over swampy ground may be constructed by dumping successive loads of rock or hard shale in a uniform layer. The thickness of this layer not to be greater than is necessary to support the construction equipment. Comment on such construction if appropriate.
- d. Placement
 - a. If the required density of in-place material is unobtainable due to moisture, the in-place material may be removed to a depth prescribed by the Engineer and/or an initial layer of rock, hard shale, or granular material may be placed. If such is the case, comment below.
 - b. Is the hauling equipment being properly distributed over the fill?
 - c. During the embankment construction operation, is the roadway being kept well drained at all times?
 - d. Are layers being constructed approximately parallel to grade?
 - e. Is each layer properly leveled, smoothed and compacted?
 - f. Is each layer properly extending across the entire fill?
 - g. Embankment Depth:

Random Material (as defined in 716)

- shall not exceed a 150 mm layer thickness after compaction

Hard Shale (as defined in 716)

- 66% or more of random material shall not exceed a 150 mm layer thickness after compaction.
- 35% to 65% random material shall not exceed 300 mm before compaction.
- 0% to 35% random material shall not exceed 600 mm.

Rock (as defined in 716)

- 66% or more of random material shall not exceed a 150 mm layer thickness after compaction.
- 35% to 65% random material shall not exceed 300 mm before compaction.
- 0% to 35% random material shall not exceed 900 mm.

Based on these parameters, comment on the various depths of materials observed.

- Record measurements:

Type of Material	Location (Sta.#)	# of Lifts	Thickness (mm)	Embankment Width (meters)

- e. When the plans specify "Select Embankment" this material shall consist of rock and shall not contain more than 15% of other suitable unclassified material. Comment on any sites using "Select Embankment".
 - f. Comment on any fabric/soil reinforcement usage.
2. Compaction
- a. Are sufficient leveling and compacting equipment being provided to level and compact without delay after material has been deposited?
 - b. Are layers of soil within +3% to -4% of optimum moisture (except soils with pronounced elasticity which are to be dried to optimum)?
 - c. Are soils having less than 40% retained on 19 mm sieve being compacted to not less than 95% of optimum density?
 - d. Are materials with more than 40% retained on 19 mm being compacted to the satisfaction of the Project Engineer?
 - How is compaction being checked (by nuclear method or other test methods such as a 50 MG proof roller)?
 - e. Is hard shale being broken down until the voids between particles are substantially filled?
 - f. Comment on the compaction at the edge of the embankment.
 - g. Comment on the "Proof Roller" operation?
3. General Items
- a. Does the project have adequately experienced personnel?
 - b. Is erosion control adequate (Berms, slope drains, etc.)?
 - c. Are there any weaknesses in the specifications or construction manual noted?

B. EXCAVATION, BORROW, AND WASTE

1. Excavation (Section 207)
- a. Do slope lines conform to plan lines and grades within acceptable tolerances?
 - b. Are slopes being trimmed in a neat and clean fashion?
 - c. Any instances noted where slopes are being undercut?
 - d. Are the tops of all slopes, except in rock, being properly rounded?
 - e. Is the contractor taking proper precautions to prevent slides?
 - f. If explosives are being used, is the required presplitting being done?

- g. Comment of presplitting requirements:
- Single row of holes along neat excavation line,
 - 600 mm to 1500 mm spacing of holes, as determined by field demonstration. Has documentation of field demonstration been made?
 - Comment on the adequacy of the presplitting. Is presplitting is not achieving desired results, can spacing be reduced?
- h. Where rock, shale, boulders, coal, or other solid material is encountered, is excavation being carried 150 mm below subgrade?
- i. Is all suitable material excavated being used for embankments?
- Does the material meet specification requirements?
- j. Are materials which can not be satisfactorily placed and compacted to a stable and durable condition being designated as unsuitable?
- k. Soil that contains excessive moisture shall be considered unsuitable, however, the contractor, at his option, may dry the material. If the contractor elects to waste rather than dry the material, is suitable replacement material, if needed, being furnished and placed at contractor's expense? (Note that any material borrow shall be in accordance with Section 211 of the Standard Specifications - see below.)
2. Borrow (Section 211)
- a. What types of borrow are being used (Unclassified Borrow, Rock Borrow, and/or Select Borrow)?
- b. Is borrow excavation placement being held off until after the roadway excavation has been utilized and there is no likelihood of slips or excess material?
- c. If borrow is acquired which causes subsequent waste of unclassified excavation, is the waste being deducted from the borrow?
- d. Has a site grading plan for all borrow sites been submitted by the contractor for approval? Was borrow site reviewed for archeological resources?
- e. Are materials being obtained from borrow pits in such a manner as to minimize pollution and sedimentation?
- f. Are borrow pits being excavated below the level of natural drainage?
- g. Are borrow pits being graded, fertilized, seeded, and mulched in accordance with Section 642 and/or 652 of the Standard Specifications?
3. Waste
- a. Is surplus material being used to flatten slopes when possible?
- b. Has the contractor located waste sites outside those shown on the plans?
- c. Has the contractor provided a plan to show the limits and details of all the waste sites for approval? Any waste in 100 year flood plain?

- d. Have the waste areas been properly graded, fertilized, seeded, and mulched in accordance with Section 642 and/or 652 of the Standard Specifications?
 - e. Is Erosion control adequate?
4. General Items

Were any weaknesses noted in the specifications, construction manual, or other procedures?

C. DOCUMENTATION - EXCAVATION AND FILL OPERATION

- a. Review the Supervisor's Daily Reports and Inspector's Daily Reports (IDR's) and comment on information presented in regard to lift thickness, compaction, and moisture content.
- b. Review the Density Test Reports and comment while noting the following parameters:
 - Moisture (+3% to -4%) and Density (95% minimum)
 - Minimum frequency (1 test per lift or 1 test per 1900 m³(1 test per 120 m on subgrade)

What action has been taken on any failing tests?

- c. Any problems noted with Independent Assurance Sampling?
- d. Review the documentation of the Monthly Estimate (page 111 of 1980 Construction Manual) for completeness.
- e. Review executed Borrow Pit Agreements (if applicable) and comment.
- f. Review executed Waste Pit Agreements (if applicable) and comment.

D. PIPE INSTALLATION (SECTION 604)

- . Does the pipe installations reviewed fulfill the purpose for which it was designed?
- a. Trench Excavation:
 - **450 mm to 1350 mm Culvert Pipes** - In complete or partial fill sections, before trenching is begun, the fill shall be constructed for a minimum of six diameters on each side of the conduit and to a height of 600 mm over the top of the conduit or to the surface of the completed embankment if less than 600 mm to the top of the conduit. The width of the trench, in either cut or fill sections, shall not be less than the outside diameter of the conduit or encasement plus 450 mm on each side as measured to the face of the trench.
 - **1500 mm + Culvert Pipes** - In complete or partial fill sections, before trenching is begun, the fill shall be constructed for a distance of six diameters on each side of the conduit and to a minimum height of 25 percent of the vertical dimension of the conduit. The width of the trench shall not be less than the outside diameter of the conduit plus one diameter on each side of the conduit.

In rock or shale cuts sections, the width of the trench shall be not greater than required to obtain the backfill compaction specified. Soli cut trenches shall be treated as complete or partial fill sections. For rigid pipe, the

width of the trench shall not be less than the outside diameter of the conduit plus 24 inches on each side of the conduit.

Base on these parameters, comment on the various pipe trenching sites observed.

b. Bedding

- Has a bedding class been specified?
- If not, Class B bedding, which is an earth foundation, shall apply. If Class B Bedding is being used, is it being carefully shaped by means of a template to fit the lower 15% (height) of the conduit?

c. Laying and Joining

- Is pipe placement beginning at the downstream end?
- Comment on the joints. (Is the pipe being joined properly?)

d. Backfill Operation

- Is the selected embankment material, free from large lumps, clods, or rocks (larger than 75 mm), and placed in layers not exceeding 100 mm of compacted depth? (For flexible conduit 1500 mm thru 2700 mm, the backfill shall be crushed aggregate backfill.)
- Is the use of a bulldozer or other blade equipment being used?
- Is the pipe backfill being brought up evenly on both sides?
- Is the required 1.2 m of cover in place before heavy equipment can haul over the pipe?
- For 1500 mm+ pipe is the required crushed aggregate backfill being used?
- Is the compaction requirements of 95% minimum density and a moisture content of +3% to -4% of optimum within acceptable tolerances?

Record Measurements: Location -

Density Reading	Target Density	% of Target	% Moisture	Optimum Moisture

e. Documentation - Pipes

- Review Inspector's Daily Reports (IDR) in regard to such documented information as pipe length, size, station, trench width, fill height, and lab numbers, etc.

- Review Density Test Reports and comment in regard to specification compliance, Minimum testing frequency (one/day/installation), Independent Assurance Sampling, and action taken on failing tests results.
- In regard to Pipe Test Reports (1994 Specifications - Sections 713 & 714), were all pipes pre-sampled?
- Materials Records (HL-440's), comment in regard to the following:
 - . Timely entries from IDR's
 - a. Delivery of Material
 - b. Testing of Materials
 - c. Placement of Materials
 - d. Documentation of Monthly Estimate

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