

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
CONTRACT ADMINISTRATION DIVISION

MATERIALS PROCEDURE

GUIDE FOR QUALITY CONTROL OF COMPACTION

- 1.0 PURPOSE
- 1.1 This procedure sets forth guidelines for the contractor's Quality Control Plan for embankment, subgrade, pipe and structure backfill material and aggregate base courses.
- 2.0 SCOPE
- 2.1 This procedure is applicable to all items requiring compaction control except bituminous concrete pavements.
- 3.0 REFERENCES
- 3.1 MP 700.00.06
MP 700.00.24
MP 207.07.20
MP 712.21.26
MP 700.00.50
WV Division of Highways Construction Manual
WV Division of Highways Standard Specifications
- 4.0 As required by the Specifications, a Quality Control Plan must be designed by the Contractor and submitted to the Engineer at the preconstruction conference. The plan should clearly describe the methods by which the Quality Control Program will be conducted. The plan may be updated as required during the life of the contract. Changes in the plan must be approved by the Division prior to being implemented.

-
- 5.0 MINIMUM REQUIREMENTS OF THE CONTRACTOR'S QUALITY CONTROL PLAN
- 5.1 Identifying Information
- 5.1.1 The plan should include the project number, route number, location, county, district, and items to be controlled.
- 5.2 Personnel
- 5.2.1 Provide the name of the company official for the project who is responsible for quality control and liaison with the Division's personnel.
- 5.2.2 List all inspectors for the project including the certification number for certified compaction inspectors and a resume' for each assistant who works under the supervision of a certified inspector.
- 5.3 Field Test Methods
- 5.3.1 Compaction tests are performed according to MP 207.07.20 and MP 700.00.24.
- 5.3.2 Specify in the plan the methods by which each item will be tested. Table A and Table B (attached) summarizes the different materials, minimum frequencies, and the appropriate test procedure or method for controlling each material. A flow chart for embankment material, Table C attached, is intended to serve as a guide for making field decisions to insure that each type of material is properly placed.
- 5.4 Test Equipment
- 5.4.1 The Plan should include a statement that all necessary test equipment will be provided. Materials Procedures 700.00.24 and 207.07.20 lists the required test equipment for compaction tests.

- 5.4.2 List all nuclear gauges to be used including serial number, manufacturer, model number, calibration data, and frequency of calibration. The calibration frequency must be acceptable to the Division. Nuclear gauges must be calibrated at least once every two years.
- 5.4.3 Outline the procedure for performing a stability check on nuclear gauges which are not within the tolerance range for standard counts during the interval between calibrations. Standard counts derived during the stability check for stable gauges may be used in lieu of the manufacturer's standards. Gauges found to be unstable can not be used until repaired and calibrated.
- 5.5 Lot and subplot sizes
 - 5.5.1 Include in the plan the lot and subplot sizes to be used for testing each type of installation. During construction, some flexibility in lot sizes may be made if the situation warrants in order to maintain a workable system. For example, two or more areas containing small quantities of embankment material might be combined into one lot at the Contractor's option and subject to the Division's approval.
 - 5.5.2 Specify the maximum time period for completion of a lot of embankment material. As a guide, if the desired lot size can not be obtained within seven calendar days, then the material placed up to that time would constitute the lot and the specified number of tests for a lot would still be performed.
 - 5.5.3 Specify in the plan when quality control tests for base and subgrade will be performed. Quality control tests are to be performed after the material has been shaped and final rolling has been completed.
 - 5.5.4 The Contractor is responsible for the accuracy of his testing and calculations.
- 5.6 Forms, Documentation, and Distribution
 - 5.6.1 List the forms and method of distribution for tests and measurements.

-
- 5.6.1.1 Compaction test results are reported on forms specified in MP 207.07.20 and MP 700.00.24. The forms are supplied by the Division. Each form consists of an original and one copy. The original of a completed form is submitted to the Division's project supervisor and the other copy is for the Contractor's records.
- 5.6.2 Indicate the length of time after tests and measurements are completed that documentation will be provided.
- 5.6.2.1 Test results and measurements are made available to project personnel for review on a daily basis. Formal submission of measurements should be made within 24 hours after the measurements are taken and test results within 24 hours after testing of a lot is completed.
- 5.6.2.2 Tests performed in a lot before final rolling is completed should be submitted to the project supervisor and retained in the project files. This includes test documents for failing lots, moisture checks, etc.
- 5.7 Compaction Equipment
- 5.7.1 List the compaction equipment giving the quantity, make, model, and weight or applied force at which each roller will be operated. If ballast will be added to a roller, indicate the type and quantity of ballast and the method for verifying the gross weight. Attach the manufacturer's specifications for compaction capabilities for each roller to the plan or state the procedure for verifying the compaction capabilities of each roller in cases where the manufacturer's specifications are not available.
- 5.7.2 Indicate in the plan that a minimum of a 10 ton (9.07 Mg) roller will be used for test sections as per MP 700.00.24.
- 5.8 Proof Rolling
- 5.8.1 Specify the method by which proof rolling will be conducted on embankment materials. The materials to be proof rolled are summarized in Table B attached.

5.8.2.1 List the number of passes to be made and corrective measures if soft areas are detected. Documentation should include the type of material, number of passes, and corrective action if soft areas are detected.

5.8.3 Specify the make, model, and type of proof roller. If ballast will be added, explain how the gross weight will be determined. For alternate proof rollers, attach to the plan the calculations used to determine that the roller meets specifications. Also, attach the manufacturer's specifications for all proof rollers to the plan. The following calculation is used to determine if an alternate proof roller meets specifications:

ENGLISH

Metric

$$c = \frac{\sqrt{(ab\pi)}}{2}$$

$$c = \frac{\sqrt{(ab\pi)}}{50.8}$$

Where:

a = weight(force) on a single tire = pounds (kg x .009807 = kN)

b = operating tire pressure = psi (kPa)

c = weight(force) per inch (mm) width of tire = pounds per inch (Nm)

The weight (force) per inch (mm) width of tire must be equal to or greater than 1315 pounds (9.067 kN/mm).

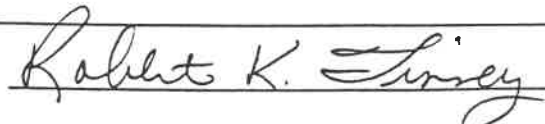
5.9 Test Section

5.9.1 Outline the procedure for notifying the Division when the test section in MP 700.00.24 will be performed. The Division should be notified a minimum of 24 hours in advance unless other arrangements acceptable to the Division can be made.

5.10 Laboratory Testing

5.10.1 Specify in the plan the sampling frequency, place of sampling, and test procedures for material requiring laboratory testing. List the testing laboratory and the qualifications of the personnel performing the testing.

-
- 5.10.1.1 Laboratory testing for random material is not required unless the material has unusual characteristics or differs from the soil and rock data used to develop the design. Testing to develop density curves, specific gravities, organic content, etc. may be required. A list of test procedures is contained in Section 716 of the Standard Specifications.
- 5.10.1.2 Laboratory test procedures for granular material for subgrade are listed in Section 716 of the Standard Specifications. The minimum frequencies for gradation and plasticity index tests are specified in Table D attached. Sampling of the material is according to MP 700.00.06.
- 5.10.1.3 Laboratory test procedures for gradation tests on select material for backfilling are listed in Section 716 of the Standard Specifications. The minimum frequency for gradation tests is specified in Table D attached.
- 5.11 Nonspecification Material
- 5.11.1 Design a plan of action for the disposition of nonspecification material, such as material with excessive moisture, excessive organic content, etc. The project supervisor should be immediately notified in the event a nonconformance situation is detected.
- 5.12 Lift Thickness Measurements
- 5.12.1 List the method(s) and frequencies by which lift thickness measurements will be taken. One method of measuring lift thicknesses is specified in the Construction Manual. The minimum frequency for lift thickness measurements is specified in Table E attached.



Robert K. Tinney, Director
Contract Administration Division

RKT:Sra

Attachments

TABLE A
COMPACTION CONTROL OF AGGREGATE BASE COURSES

| TEST PROCEDURE | LOT SIZE | NUMBER OF TESTS | MATERIAL TYPE | | | |
|----------------|---------------------------|---------------------|---|--|---|-------------------------|
| | | | PORTLAND CEMENT TREATED AGGREGATE BASE COURSE | CRUSHED AGGREGATE BASE AND SUBBASE COURSES | HOT-MIX HOT-LAID BITUMINOUS TREATED BASE COURSE | SOIL CEMENT BASE COURSE |
| MP700.00.24 | 2000 FEET (600 METERS) | 1 PER | | | | |
| | | SUBLOT 5 PER LOT | X | X | X | |
| MP207.07.20 | 2000 FEET (600 METERS) | 1 PER | | | | |
| | | SUBLOT 5 PER LOT | | | | X |

TABLE B
COMPACTION CONTROL OF EMBANKMENT
BACKFILL AND SUBGRADE

| TEST | LOT SIZE | NUMBER OF TESTS | MATERIAL TYPE | | | | | | |
|---------------|-------------------------|---------------------------------|---|--|----------------|--|---------------|----------------------|--|
| | | | MATERIAL WITH 40% LESS THAN 40% RETAINED ON 3/4" (300 SIEVE) | MATERIAL WITH 40% OR MORE RETAINED ON THE 3/4" (19 MM) SIEVE AND PLACED IN A 12" (300 MM) LIFT OR LESS | | MATERIAL THAT CAN BE PLACED IN A LOOSE LIFT GREATER THAN 12" (300 MM) | | GRANULAR SUBGRADE | SELECT MATERIAL FOR BACKFILLING AND CLASS 1 AGGREGATE |
| | | | | UNIFORM | NON UNIFORM | ROCK | HARD SHALE | | |
| MP 207.07.20 | SEE STAND. SPECS. | 1 PER SUBLOT 5 PER LOT | X | | | | | | |
| MP 700.00.24 | SEE STAND. SPECS. | 1 PER SUBLOT 5 PER LOT | | X [1] | | | | X | X |
| PROOF ROLLING | | 1 REPORT PER LIFT | | | X [2] | | X | | |

Notes:

1. If a hole for a direct transmission density reading cannot be readily made due to coarse material, material, proof roll the lift.
2. Material shall be considered non-uniform if the percent of random material varies by more than 25% by visual inspection.

TABLE C

GUIDE FOR CONTROL OF EMBANKMENT MATERIAL

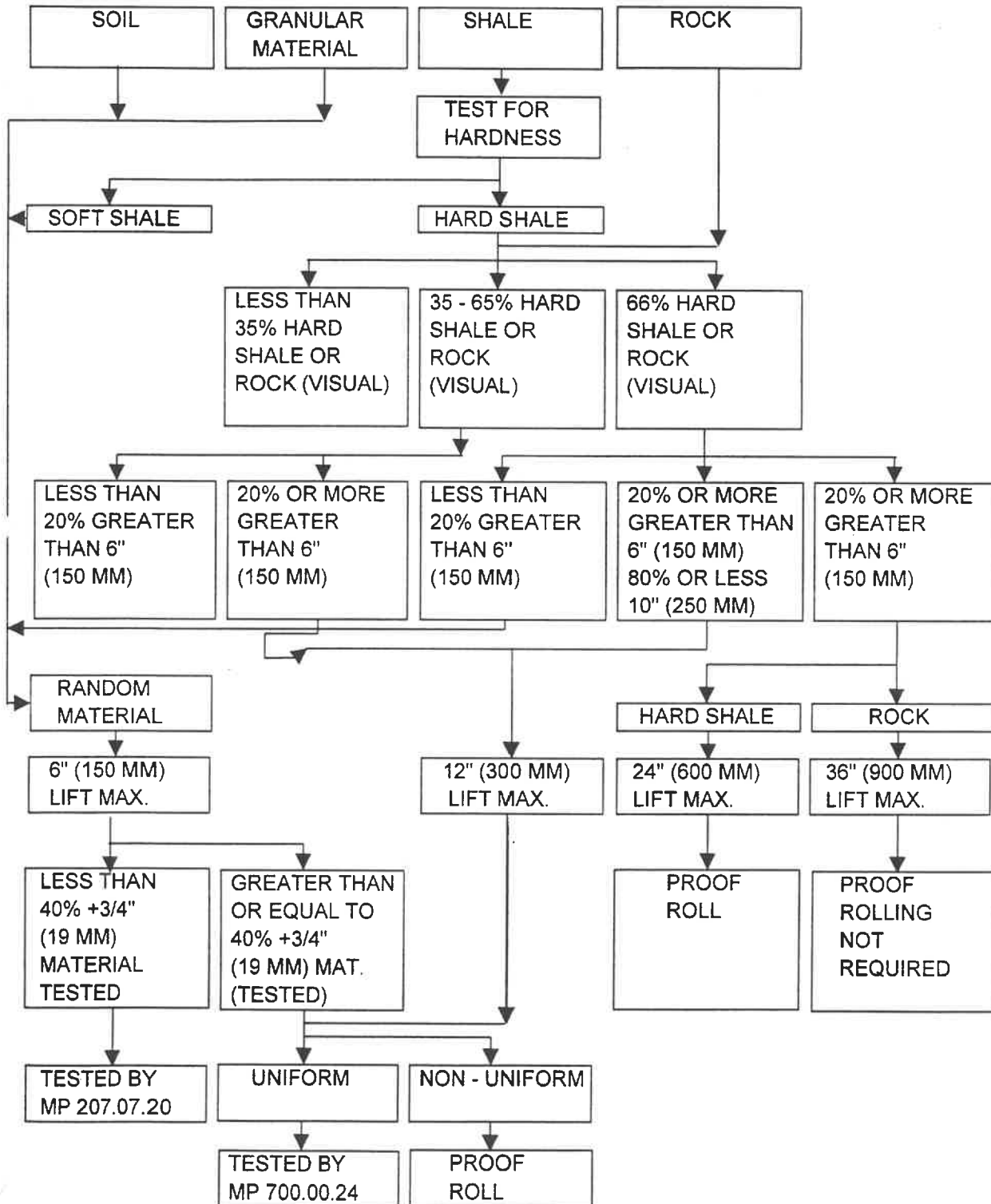


TABLE D
LABORATORY TESTING OF GRANULAR MATERIAL FOR
SUBGRADE AND SELECT MATERIAL FOR BACKFILLING

| MATERIAL TYPE | TEST | FREQUENCY |
|---------------------------------|---------------|---|
| GRANULAR MATERIAL FOR SUBGRADE | GRADATION | MINIMUM OF 1 PER DAY OF PLACEMENT |
| GRANULAR MATERIAL FOR SUBGRADE | PLASTIC LIMIT | MINIMUM OF 1 PER 6 DAYS OF PLACEMENT |
| SELECT MATERIAL FOR BACKFILLING | GRADATION | MINIMUM OF 1 PER DAY OF STOCKPILING PRODUCTION, OR SHIPMENT |

TABLE E

LIFT THICKNESS MEASUREMENTS

| MATERIAL TYPE | NUMBER OF MEASUREMENTS |
|--------------------|---|
| EMBANKMENT | MINIMUM OF 3 PER LIFT |
| SUBGRADE | MINIMUM OF ONE PER 1200 FEET (350 M) PER WORKING WIDTH |
| PIPE BACKFILL | MINIMUM OF ONE PER SIDE PER LIFT |
| STRUCTURE BACKFILL | MINIMUM OF ONE PER LIFT |

