

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION  
DIVISION OF HIGHWAYS  
MATERIALS CONTROL, SOILS AND TESTING DIVISION

MATERIALS PROCEDURE

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GUIDE FOR QUALITY CONTROL OF COMPACTION

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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 QUALITY CONTROL PLAN

- 4.1 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 that 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. All personnel performing compaction tests must be Certified Compaction Inspectors.
- 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 MP 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 Sublot Sizes
- 5.5.1 Include in the plan the lot and sublot 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 their individual 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).

5.8.2.1.1 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.

5.8.2.2 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 Non-Specification Material
- 5.11.1 Design a plan of action for the disposition of non-specification 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).
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Attachments

TABLE A  
COMPACTION CONTROL OF AGGREGATE BASE COURSES

TEST PROCEDURE	LOT SIZE	NUMBER OF TEST	MATERIAL TYPE			
			PORTLAND CEMENT TREATED AGGREGATE BASE COURSE	CRUSHED AGGREGATE BASES AND SUBBASE COURSES	HOT-MIX HOT-LAID BITUMINOUS TREATED BASE COURSE	SOIL CEMENT BASE COURSE
MP 700.00.24	2000 FEET (600 METERS)	1 PER SUBLOT 5 PER LOT	X	X	X	
MP 207.07.20	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 WITH LESS THAN 40% RETAINED ON ¾" (19.0 mm) SIEVE	MATERIAL WITH 40% OR MORE RETAINED ON ¾" (19.0 mm) SIEVE AND CAN BE PLACED IN A 12" (300 mm) LOOSE 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 I AGGREGATE
				UNIFORM	NON UNIFORM	ROCK	HARD SHALE		
MP 207.07.20	SEE STD. SPECS.	1 PER SUBLLOT 5 PER LOT	X						
MP 700.00.24	SEE STD. SPECS.	1 PER SUBLLOT 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 the coarse 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

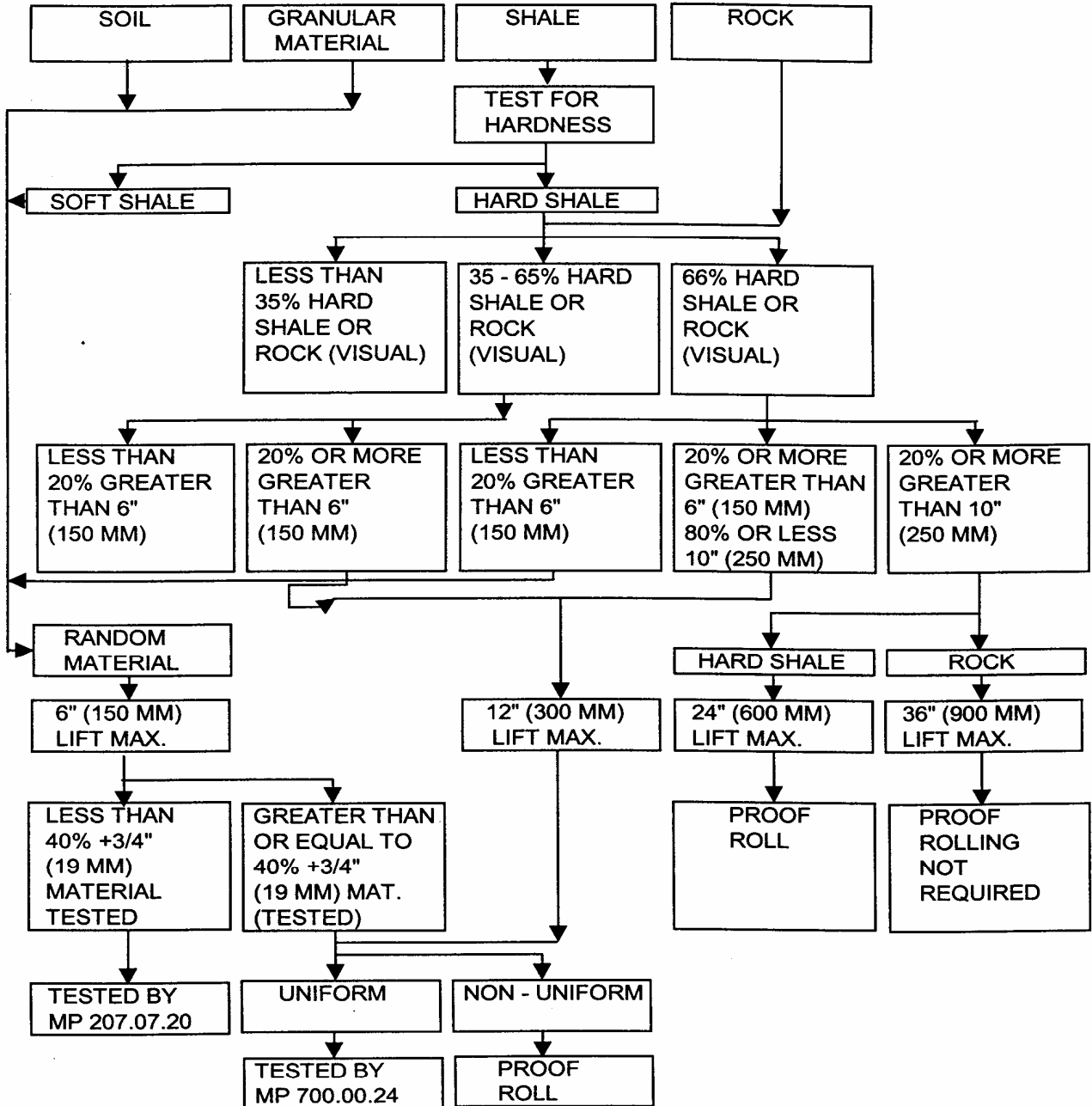


TABLE D  
LABORATORY TESTING OF GRANULAR MATERIAL FOR  
SUBGRADE AND SELECT MATERIAL FOR BACKFILLING

MATERIAL TYPE	TEST	FREQUENCY
GRANULAR MATERIAL FOR SUBGRADE	GRADATION	MINIMUM OF 1 PER DAY OF PLACEMENT NOTE 1
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

Note 1: In the event project activities are such that relatively small quantities of material are being placed per placement date, and to prevent over sampling, the Engineer may approve the following alternate sampling method: During one or more consecutive placement dates, one sample shall be taken to represent a maximum of 170 cubic yards (250 tons). In this case the sample shall be taken at a random time and place, represent the same material and production, and shall represent material placed during a period not to exceed one week.

TABLE E  
LIFT THICKNESS MEASUREMENTS

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