METHODS OF SAMPLING AND TESTING
MT 218-20
METHOD OF TEST FOR
DETERMINING RELATIVE COMPACTION AND PERCENT MOISTURE
(*Montana Test Method*)

1 Scope

1.1 This procedure is intended as a guide for comparing in-place moisture and density to optimum moisture and maximum density, respectively, in order to determine compliance with standard specifications and contract special provisions.

2 Referenced Documents

MT Materials Manual
MT 210 Moisture-Density Relations of Soils Using a 5.5 lb. Rammer
MT 212 Determination of Moisture and Density of In-Place Materials
MT 230 Moisture-Density Relations of Soils Using a 10 lb. Rammer

3 In-Place Moisture and Density

3.1 The in-place moisture and density shall be determined in accordance with MT 212.

4 Optimum Moisture and Maximum Density

4.1 The optimum moisture and maximum density shall be determined in accordance with MT 210 or MT 230, Method A, B, C, or D, whichever is applicable, using the following criteria as a guide.

4.2 When the material under test is a soil or aggregate consisting of entirely minus 4 mesh (4.75 mm), Method A or B will be used.

4.3 When the material under test is a soil or aggregate with a maximum size of 3/4 inch (19.0) mm), Method C or D will be used.

4.4 When the material under test is a soil or aggregate with a maximum size of 2 inches (50 mm), Method D will be used.

4.5 When the material under test is a soil or aggregate with a maximum size of 4 inches (100 mm) and no more than 50% of the material under test is retained on the 4 mesh (4.75 mm), Method D will be used.

4.6 When the material under test is a soil or aggregate with a maximum size larger than 2 inches (50 mm) and more than 50% of the material under test is retained on the 4 mesh (4.75 mm), the material will not be required to meet 95% density within 2% optimum moisture.

4.6.1 A screen analysis must be provided on representative samples from each lift of the embankment area to prove that more than 50% of the material is retained on the 4 mesh (4.75 mm) sieve.

4.6.2 Nuclear moisture and/or density readings (MT 212) must be taken on each lift in the embankment area to demonstrate that uniform relative density has been achieved. Report percent moisture and density reading to the nearest whole percent.

4.6.3 Notes must be made on the Summary of Compaction Data (Form 1006) showing the results obtained in paragraphs 4.6.1 and 4.6.2.

5 Calculation

5.1 Determine the relative compaction by dividing the in-place density (pounds per cubic foot) by the maximum density (pounds per cubic foot) and multiplying by 100.

5.2 A direct comparison of the in-place moisture and the optimum moisture will determine compliance with specifications.

6 Family of Curves

6.1 A "family of curves" is a term applied to a number of moisture-density curves which are plotted on one cross-section sheet, using the same ordinates and abscissas as dry weights pounds per cubic foot and moisture contents, respectively. The family of curves is plotted, initially, from values obtained by the sampling and testing of the various soil types during the Preconstruction Soils Survey and every effort must be made to sample and identify all of the various soil types that will be encountered on the project. Each new soil type, or mixture of soils, encountered on the project during construction, will be represented by a moisture-density curve, which is added to the "family".

Note 1 – New curves drawn through plotted one-point determinations shall not become a permanent part of the family of curves until verified by a full moisture-density relationship.

7 One-Point Proctors

7.1 A "one-point Proctor" is an abbreviated standard Proctor compaction test and is used in conjunction with the family of curves. Rather than determining the moisture and density points for an entire curve, a single point is determined for the purpose of selecting the curve, which represents the soil being compacted, from the family of curves.

7.1.1 One-point Proctors shall be run whenever there is any doubt that the soil being compacted is from a location on the project, which is represented, by one of the curves in the family of curves.

7.1.2 Frequently soils may be mixed by heavy equipment excavating and hauling to the embankment site and a one-point Proctor may not fit any of the established curves. In these cases, a new curve will have to be prepared from the mixture and added to the family of curves.

7.1.3 It is necessary to run the one-point Proctor as close to optimum moisture as possible. The point should be within plus or minus three percent of optimum on most curves and within plus or minus two percent of optimum on sharp breaking curves. If the point is established on either side of optimum and some distance from the peak of the curve, it may very well fit more than one curve in the family of curves, or none at all and it will be impossible to select the proper curve.

7.1.4 The moisture and density results obtained by the one-point Proctor are plotted on the family of curves and, when obtained near optimum, will fall near one of the curves in the family of curves, provided that particular type of soil or mixture of soils has been tested for optimum moisture and maximum density. The peak of the curve selected shall be considered the optimum moisture and maximum density of the material represented by the one-point Proctor.

Note 2 – If the one-point plotted within or on the family of curves does not fall in the 80 to 100 percent of optimum moisture range, compact another specimen, using the same material, at an adjusted moisture content that will place the one-point within this range.

8 Numbering Check Samples

When a check sample is taken it will be assigned the same number as the sample being checked, with the addition of a letter suffix. For example, if sample number 38 failed to meet specifications, the first check sample would be numbered 38-A, the second check sample would be 38-B.