T 272

FAMILY OF CURVES – ONE-POINT METHOD

FOP FOR AASHTO

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01 ## Significance

02 Soils sampled from one source will have many different moisture-density curves, but if a group of these curves is plotted together, similarities or relationships are usually seen. A family of curves is a group of soil moisture-density relationships that reveal similarities characteristic of the soil type and source. Higher density soils have curves with steeper slopes and maximum dry densities at lower optimum moisture contents, while the lower density soils have flatter curves with higher optimum moisture contents. Figure 1 is an example of such a curve, and was taken from AASHTO T 272.

03 In the field, density and moisture content are determined, and a single point is plotted on the family of curves. If the point plots on a curve, that curve may be used to represent the moisture-density relation for the soil. If the point plots between two curves, a new curve is sketched between the existing curves and the new curve is used.

Scope

This procedure provides for a rapid determination of the maximum density and optimum moisture content of a soil sample utilizing a family of curves and a one-point determination in accordance with AASHTO T 272. This procedure is related to FOP for AASHTO T 99/T 180.

04 One-point determinations are made by compacting the soil in a mold of a given size with a specified rammer dropped from a specified height. Four alternate methods – A, B, C, D – are used and correspond to the methods described in FOP for AASHTO T 99/T 180. The method used in AASHTO T 272 must match the method used in FOP for AASHTO T 99/T 180.

Apparatus

See the FOP for AASHTO T 99/T 180.

Sample

Sample size determined according to the FOP for AASHTO T 310. In cases where the existing

family can not be used a completely new curve will need to be developed and the sample size will be determined by the FOP for AASHTO T 99/T 180.

Procedure

See the FOP for AASHTO T 99/T 180.

Calculations

See the FOP for AASHTO T 99/T 180.

Maximum Dry Density and Optimum Moisture Content Determination

05 1. If the moisture-density one-point falls on one of the curves in the family of curves, the maximum dry density and optimum moisture content defined by that curve shall be used.

2. If the moisture-density one-point falls within the family of curves but not on an existing curve, a new curve shall be drawn through the plotted single point parallel and in character with the nearest existing curve in the family of curves. The maximum dry density and optimum moisture content as defined by the new curve shall be used.

3. The one-point must fall either between or on the highest and lowest curves. If it does not, then a full curve must be developed.

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

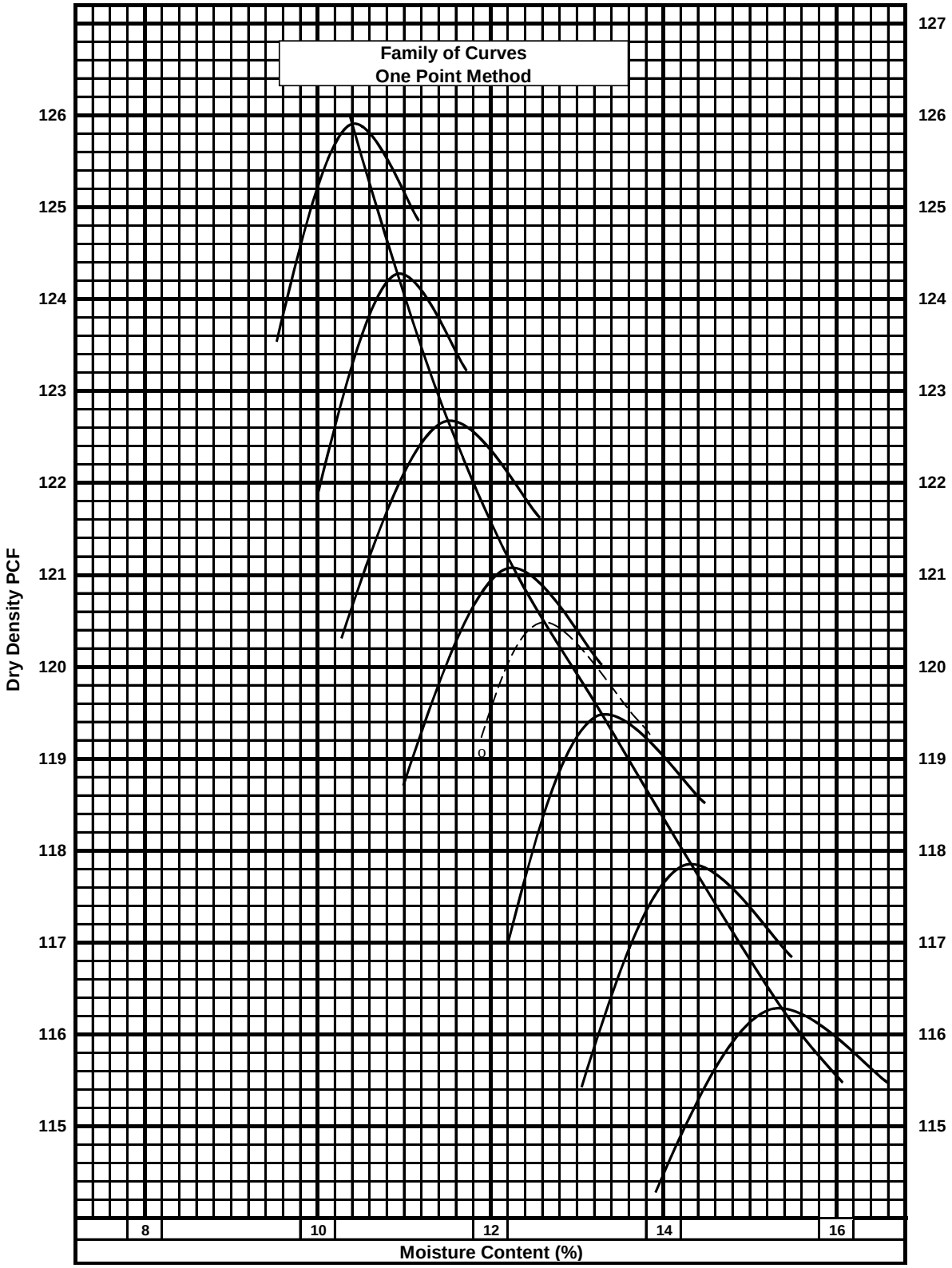
5. If the family of curves is such that the new curve through a one-point is not well defined or is in any way questionable, a full moisture-density relationship shall be made for the soil to correctly define the new curve and verify the applicability of the family of curves.

Note 1: New curves drawn through plotted single point determinations shall not become a permanent part of the family of curves until verified by a full moisture-density procedure following the FOP for AASHTO T 99/T 180.

Example: 07

A moisture-density procedure (AASHTO T 99 or AASHTO T 180) was run. A dry density of 119.1 lb/ft^3 at 11.9 percent moisture were determined. This point was plotted on the appropriate family between two previously developed curves.

The "dashed" curve beginning at the moisture-density one-point was sketched between the two existing curves. A maximum dry density of 120.4 lb/ft^3 and optimum moisture of 12.7 percent were estimated.


Family of Curves
One Point Method
Dry Density PCF
127
126
125
124
123
122
121
120
119
118
117
116
115
8
10
12
14
16
Moisture Content (%)

09

Report

Results shall be reported on standard forms approved by the agency. Report maximum dry density to the closest 0.1 lb/ft^3 and optimum moisture content to the closest 0.1 percent.

10

Tips!

- Make sure that the moisture content of the one-point sample is between 80 and 100 percent of optimum.
- Remember that a full moisture-density procedure shall be made if the curve drawn through the one-point is not well defined or is questionable.

REVIEW QUESTIONS

1. With what other procedure(s) is this procedure related?

2. How are the two procedures used together?

3. Describe the limitations of using the one-point determination with a family of curves?

PERFORMANCE EXAM CHECKLIST

FAMILY OF CURVES - ONE-POINT METHOD
FOP FOR AASHTO T 272

Participant Name _____ Exam Date _____

Record the symbols "P" for passing or "F" for failing on each step of the checklist.

Procedure Element	Trial 1	Trial 2
1. One-point determination of dry density and corresponding moisture content made in accordance with the FOP for AASHTO T 99/T 180?	_____	_____
a. Correct size No.4 or 3/4 in. material used?	_____	_____
b. Correct number of blows per layer used (25 or 56)?	_____	_____
c. Correct number of layers used (3 or 5)?	_____	_____
d. Moisture content determined in accordance with FOP for AASHTO T 255/T 265 (if allowed T 217)?	_____	_____
2. One-point plotted on family of curves supplied?	_____	_____
3. One-point falls within 80 to 100 percent of optimum moisture content in order to be valid?	_____	_____
4. If one-point does not fall within 80 to 100 percent of optimum moisture content, another one-point determination with an adjusted water content is made?	_____	_____
5. Maximum dry density and corresponding optimum moisture content correctly estimated?	_____	_____

Comments: First attempt: Pass ☐ Fail ☐ Second attempt: Pass ☐ Fail ☐

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Examiner Signature _____WAQTC #:_____