

ROCK CORRECTION PROCEDURE FOR MAXIMUM DENSITY DETERMINATION OF CEMENT TREATED MIXTURES (An Arizona Method)

Scope

1. This method is to be used to determine the maximum density of the total sample of cement treated mixture for which the percentage of material retained on the No. 4 sieve has been determined as well as the maximum dry density of the passing No. 4 fraction and the bulk specific gravity of the plus No. 4 fraction. This test procedure is basically the same as ARIZ 227, Rock Correction Procedure for Maximum Density Determination, except for the addition of the concept of delay compaction time.

Procedure

2. The test is made in the following manner:

(a) Determine the maximum dry density of the material passing the No. 4 sieve by means of ARIZ 221, consistent with the desired curing time.

(b) Determine the percentage of rock (larger than the No. 4 sieve) in the total sample.

(c) Determine the bulk specific gravity of the rock in accordance with AASHTO T 85, on an oven-dried basis.

NOTE: Once determined for a source, the specific gravity may usually be used for all rock corrections on material from that source. Any slight change in specific gravity should not change the maximum density to a large extent. (A change of + 0.02 could result in a change of + 0.6 lb. per cubic foot.) Similarly, the maximum dry density of the passing No. 4 material having been determined by Method A for a source may usually be used for that source providing the screen analysis of the passing No. 4 material and the Plasticity Index remain reasonably uniform.

(d) Determine the maximum dry density of the total sample by use of the formula (e) or by use of the nomograph (f).

(e) Determination of density by use of formula:

$$D = \frac{(100 - R) d + (0.9 RS \times 62.4)}{100}$$
$$= \frac{(100 - R) d + 56.2 RS}{100}$$

Where:

D = Dry density of total sample containing R percent rock, lbs/cu. ft. (Varies according to curing time required.)

R = Percent of rock retained on No. 4 sieve.

d = Dry density of material passing No. 4 sieve, lbs./cu. ft.

S = Specific Gravity of rock.

Example:

R = 29% rock

d = 110.0 lbs. per cu. ft. (2 hour curing time.)

S = 2.50

$$D = \frac{(100 - 29) 110.0 + (56.2 \times 29 \times 2.50)}{100}$$

$$D = \frac{(71 \times 110.0) + 4074}{100}$$

$$D = \frac{7810 + 4074}{100} = 118.8 \text{ lbs. per cu. ft.}$$

D = 118.8 lbs. per cubic foot = Maximum density of total sample containing 29% rock retained on No. 4 sieve, with 2 hours allowed for sample to cure.

(f) Determination of density by use of nomograph: Use the nomograph shown in Fig. 1 following the instructions given. Data from the example above has been used to show methods for nomograph solutions.

Limitation of Method

3. The rock correction procedure is not accurate when the rock content (retained on No. 4 sieve) is in excess of 50% (or 60% in the case of uniformly graded rock which consists of 100% passing the 1 inch sieve), or when the material contains rock which will not pass a 3-inch sieve. If any of these conditions are present, the test should not be completed; however, the report should state that the test cannot be made due to excess rock, or large rock, and the sieve analysis reported to verify this. This limitation shall apply except for the case stated in Section 4.

Volcanic Cinders or Light Porous Material

4. The rock correction procedure is not accurate when the rock in the material consists of volcanic cinders or light weight porous material on which the specific gravity determination cannot be accurately made; for these materials, Methods C or D (ARIZ 226) shall be used.

Use of Results

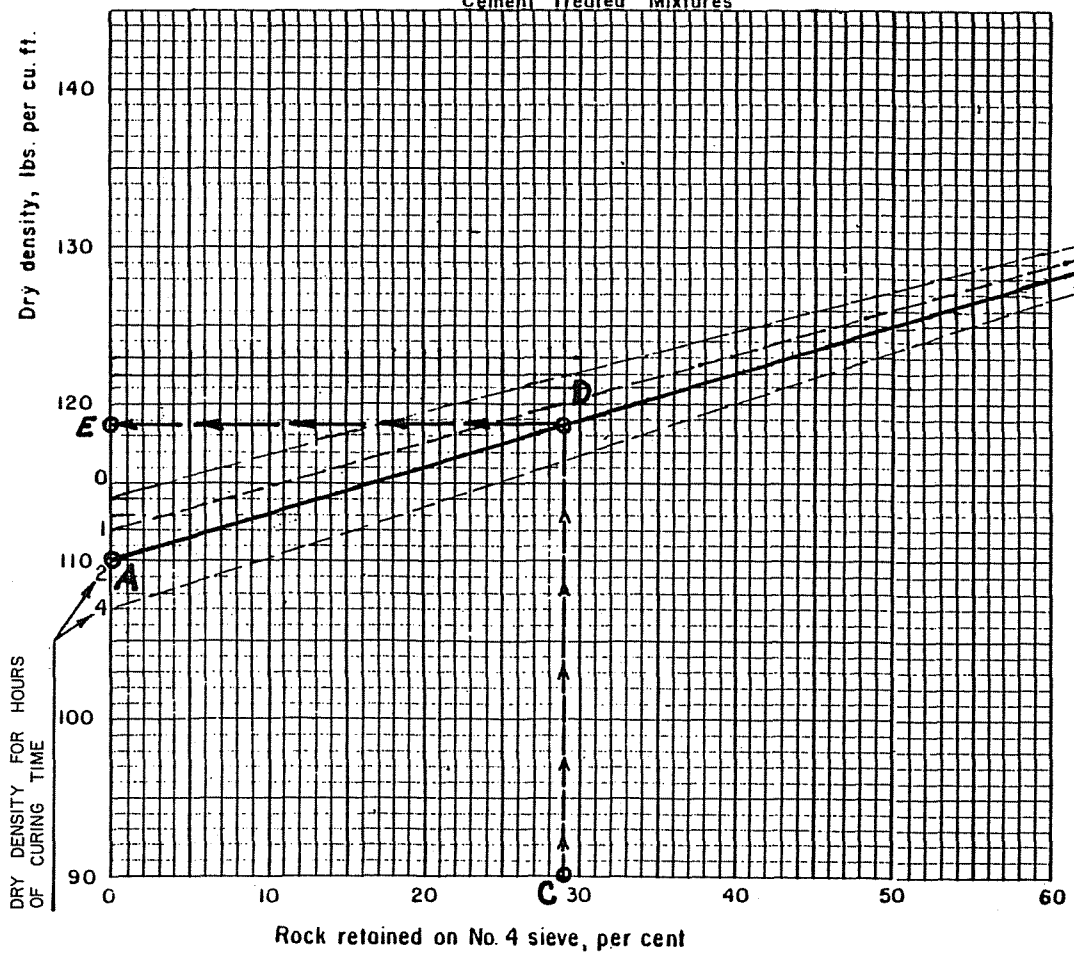
5. The maximum density obtained by this method shall be used in comparison with the determination of the field density to determine the percentage of compaction.

ARIZONA DEPARTMENT OF TRANSPORTATION

MATERIALS SECTION
 Rock Correction Procedure
 for
 Maximum Density Determination
 of
 Cement Treated Mixtures

$$D = \frac{(100-R)d + (56.2RS)}{100}$$

Where:
 D = dry density of sample containing "R"
 percent rock, lb. per cu. ft.
 R = percent rock (plus No. 4 material)
 d = dry density of portion passing No. 4
 size, lb. per cu. ft.
 S = Bulk specific gravity of rock, oven
 dry basis.



Bulk sp gr of rock, oven dry basis

2.8
2.7
2.6
2.5
2.4
2.3
2.2

Example for use of chart:
 Known - Dry density of cement treated material passing No. 4 sieve (2 hr. curing time) = 110.0 lb. per cu. ft. Plot at A.
 Note: Other curing time dry densities are plotted to indicate the anticipated pattern of results.
 Known - Specific gravity of rock = 2.5. Plot at B, draw line AB.
 Known - Percent of rock in total sample = 29. Plot at C, draw line CD and locate D at intersection with line AB.
 Draw line horizontally from point D to the left to locate point E. Dry density of total sample (2 hr. curing time) = 118.6 lb. per cu. ft.

Figure 1.