CRD-C 104-80

METHOD OF CALCULATION OF THE FINENESS MODULUS OF AGGREGATE

1. Definition

1.1 The standard definition of fineness modulus is as follows:

"An empirical factor obtained by adding the total percentages of a sample of the aggregate retained on each of a specified series of sieves, and dividing the sum by 100."

Note.- The sieve sizes used are No. 100 (150-µm), No. 50 (300-µm), No. 30 (600-µm), No. 16 (1.18-mm), No. 8 (2.36-mm), and No. 4 (4.75-mm), and 3/8-in. (9.5-mm), 3/4-in. (19.0-mm), 1-1/2-in. (38.1-mm), and larger, increasing in the ratio of 2 to 1.

2. Procedure

2.1 The values used in computing fineness modulus shall be obtained by tests conducted in accordance with CRD-C 103.

3. Range of Values

3.1 The same value of fineness modulus may be obtained from several different particle-size distributions. In general a small value indicated a fine material while a large value indicates a coarse material. The value for tine aggregates commonly ranges from 2.00 to 4.00 and for coarse aggregate from 6.50 to 8.00 when all the material is finer than the 1-1/2-in. (38.1-mm) sieve. Combinations of fine and coarse aggregates have intermediate values.

4. Example

4.1 A typical example of the calculation of the fineness modulus is shown below:

Sieve Sizes, U. S. Series	Total Percent Retained: Fine Aggregate	Coarse Aggregate	Combined Course and Fine 65:35
1-1/2-in. (38.1-mm)	0	4	3
3/4-in. (19.0-mm)	0	49	32
3/8-in. (9.5-mm)	0	91	59
No. 4 (4.75-mm)	4	100	66
No. 8 (2.36-mm)	21	100	72
No. 16 (1.18-mm)	46	100	81
No. 30 (600-µm)	74	100	91
No. 50 (300-µm)	89	100	96
No. 100 (150-µm)	95	100	98
Total	329	744	598
Fineness Modulus = Total / 100	3.29	7.44	5.98

4.2 As noted in the standard definition of fineness modulus (para 1.1) and the example shown in para 4.1, the fineness modulus is based on the percentages of aggregates *retained* on a specificed series of sieves. Many specified gradings, including those used by the Corps of Engineers, are expressed as percentages *passing* a specified series of sieves. To avoid having to make numerous calculations to change these gradings from percentages passing to percentages retained in order to calculate fineness modulus, the following procedure can be used to calculate fineness modulus using *percentages passing.* The example is for the same gradings as in para 4.1 but when they are expressed as percentages passing.

Sieve Sizes, U. S. Series	Total Percent Passing: Fine Aggregate	Coarse Aggregate	Combined Coarse and Fine 65:35
1-1/2-in. (38.1-mm)	- -	96	97
3/4-in. (19.0-mm)	- -	51	68
3/8-in. (9.5-mm)	100	9	41
No. 4 (4.75-mm)	96	0	34
No. 8 (2.36-mm)	79	0	28
No. 16 (1.18-mm)	54	0	19
No. 30 (600-µm)	26	0	9
No. 50 (300-µm)	11	0	4
No. 100 (150-µm)	5	0	2
Total	371	156	302

For this procedure

$$\text{Fineness Modulus} = \frac{N(100) - \text{Sum Total of Percent Passing}}{100}$$

where

N = number of sieves involved in the sum total of percent passing from the largest size noted to and including the No. 100 (150-µm) sieve.

Then

$$\text{Fineness Modulus} = \frac{7(100) - 371}{100} = \frac{700 - 371}{100}$$

$$\text{Fineness Modulus} = 3.29$$

Coarse aggregate

$$\text{Fineness Modulus} = \frac{9(100) - 156}{100} = \frac{900 - 156}{100}$$

$$\text{Fineness Modulus} = 7.44$$

Combined Coarse and Fine 65:35

$$\text{Fineness Modulus} = \frac{9(100) - 302}{100} = \frac{900 - 302}{100}$$

$$\text{Fineness Modulus} = 5.98$$

5. Significance and Use

A method of selecting mixture proportions for concrete based on the fineness modulus of the combined fine and coarse aggregate was proposed by Abrams in 1918. This method is not widely used today but the concept of being able to describe particle-size distributions by an index number remains useful for many purposes. Many agencies use fineness modulus variation as a convenient means of keeping quality history data on uniformity of particle-size distribution of aggregate production, delivery, and use. Some agencies require that aggregates be processed to remain within upper and lower limits of fineness modulus. Such requirements are more frequently applicable to fine aggregate than coarse aggregate or combined aggregate.