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Standard Guide for Selection of Methods of Particle Size Analysis of Fluvial Sediments (Manual Methods)[1]

This standard is issued under the fixed designation D4822; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This guide covers the selection of methods for determining the size distribution of fluvial sediments particles in the range greater than 0.45 µm using manual methods. Manual methods are defined as those methods that require the operator to do some actual measurements and calculations. An automated method would be one which, after the sample is prepared and inserted into an instrument, the instrument (machine) does the measuring and calculations, not the operator. Not all manual methods are presented in this guide. However, where available, at least two methods for each particle size range are given.

1.2 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D422 Test Method for Particle-Size Analysis of Soils

D1129 Terminology Relating to Water

D4410 Terminology for Fluvial Sediment

D4411 Guide for Sampling Fluvial Sediment in Motion

E20 Practice for Particle Size Analysis of Particulate Substances in the Range of 0.2 to 75 Micrometres by Optical Microscopy (Withdrawn 1994)[3]

3. Terminology

3.1 *Definitions*—For definitions of terms used in this guide, refer to Terminologies D1129 and D4410.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 For definitions of terms used in this guide, refer to Terminology D4410.

3.2.2 *particle count*—a method of particle size analysis in which the number of particles in the various size ranges are counted manually.

3.2.3 *particle size*—the diameter, usually the intermediate diameter, of a particle measured by settling, sieving, micrometric, or direct measurement methods (see 5.2).

3.2.4 *particle size distribution*—the relative amount of a sediment sample in a range of specific sizes in terms of percentages by mass, volume, or number, finer than a given particle size.

4. Summary of Guide

4.1 This guide consists of suggested manual test methods for analyzing fluvial sediment samples for particle size distribution.

5. Significance and Use

5.1 This guide is general and useful in helping the user to determine an appropriate manual test method for determining the particle size distribution of fluvial sediments. The suggested test methods are not described in this guide, but references are given so that the user may obtain more information about each test method.

5.2 It should be noted that different test methods may and often times do produce different particle size distributions for the same sample. This is due in part to the different test methods requiring native or distilled water, differences in

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] The last approved version of this historical standard is referenced on www.astm.org.

TABLE 1 Guide for Selection of Particle Size Analysis of Fluvial Sediments Using Manual Methods

NOTE 1—Not all test methods will give complete distribution for the size range indicated, some will only give percent finer for one or two sizes in the indicated range. See references for more detail on each test method.

M	=	Results in percent by mass	PC	=	Particle count
N	=	Results in percent by number of particles	OPC	=	Optical particle count, non-microscopic
V	=	Results in percent by volume	H	=	Hydrometer
BW	=	Bottom withdrawal	M	=	Microscopic
P	=	Pipet	D	=	Decantation
VA	=	Visual accumulation	EW	=	Elutriator, water
WS	=	Wet sieve	EA	=	Elutriator, air
DS	=	Dry sieve	C	=	Centrifugal

Methods/Sizes	BW (2, 3) [A]	P (2, 3)	VA (2, 3, 4)	WS (2, 3)	DS (2, 5)	PC (2)	OPC (6)	H (3, 7), Test Method D422 [B]	M (7, 8), Practice E20 [B]	D (7, 9)	EW (8, 9)	EA (8, 9)	C (7, 8)
Clay 0.00045–0.004 mm	M	M			M			M	V N	M		M	M
Silt 0.004–0.062 mm	M	M		M	M			M	V N	M	M	M	M
Sand 0.062–2.0 mm			M	M	M	N	V N		V N	M	M		
Gravel 2.0–64 mm					M	N	V N						
Cobbles 64–256 mm						N	V N						
Boulders >256 mm						N	V N						

[A] Numbers in parentheses indicate applicable reference in the list of references at the end of this guide.
[B] See Referenced Documents section for complete title and location.

TABLE 2 Ranges in Optimum Quantity of Sediment for Different Methods of Particle Size Analysis

Method		Range in Optimum Quantity or Concentration of Sediment
(BW)	Bottom withdrawal	0.5–1.8 g
(P)	Pipet	1.0–5.0 g
(VA)	Visual accumulation	0.05–15.0 g
(WS)	Wet sieve	>0.05g
(DS)	Dry sieve	>0.05 g
(PC)	Particle count	>100 particles
(OPC)	Optical particle count	>1000 particles
H)	(Hydrometer	40 000 mg/L [A]
(M)	Microscopic	>750 particles
(D)	Decantation	1.0–5.0 g
(EW)	Elutriator, water	10 g
EA)	(Elutriator, air	0.1–20 g
(C)	Centrifugal	0.5–2.0 volume % [A]

[A] Quantity of sediment needed to obtain this concentration will vary depending upon size of container needed to perform test method.

dispersion methods used, and differences in what the test method is measuring, that is, physical or sedimentation diameter.

6. Sampling

6.1 Collect the samples in accordance with Guide D4411 or "Field Methods for Measurement of Fluvial Sediments" (**1**).[4]

[4] The boldface numbers in parentheses refer to the list of references at the end of this guide.

7. Procedure

7.1 Visually inspect the sample or streambed to estimate particle size ranges contained in the sample.

7.2 Enter Table 1 from the left. Determine the test methods that are appropriate for: (*1*) the estimated particle size contained in the sample, and (*2*) the desired reporting units.

7.3 Details on each test method are given in the references listed under each test method.

7.4 Use Table 2 to estimate quantities of sediment needed for each type of analysis.

8. Precision and Bias

8.1 The test methods suggested in this guide have different precision ranges and biases. See References (**2-8**) and Test Method D422 for precision and bias information applicable for each test method.

9. Keywords

9.1 particle size; sediment

REFERENCES

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(4) U.S. Inter-Agency Committee on Water Resources, Subcommittee on Sedimentation, "Operators Manual on the Visual-Accumulation-Tube Method for Sediment Analysis of Sands," *Report K of Sediment Loads in Streams,* p. 28, 1958.

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(9) U.S. Inter-Agency Committee on Water Resources, Subcommittee on Sedimentation, "Measurement and Analysis of Sediment Loads in Streams," Report No. 4, *Methods of Analyzing Sediment Samples*, p. 203, 1941.