



Standard Test Method for Open-Channel Measurement of Time of Travel Using Dye Tracers¹

This standard is issued under the fixed designation D 5613; 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 test method covers a means of measuring the time-of-travel of water and waterborne solutes by the use of dye tracers and tracing techniques. This test method is similar to methods developed by the U.S. Geological Survey and described in other referenced documents.

1.2 This test method describes the dye tracers, measuring equipment used, and field and laboratory procedures customarily used.

1.3 This test method describes the methods of tracer study analysis and data presentation.

1.4 The user of this test method should address the following concerns regarding the use of tracers in water bodies:

1.4.1 Determine whether the chemical has clearance or approval or has potential or preceived impacts relating to potable, industrial, irrigation, or fish and wildlife use.

1.4.2 Determine whether approvals are required by involved agencies.

1.4.3 Document contacts regarding notification.

1.5 The values stated in inch-pound units except for chemical concentrations and liquid volumes for step dilutions, which are stated in SI units, are to be regarded as the standard.

1.6 *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.* For specific hazards statements, see Section 9.

2. Referenced Documents

2.1 ASTM Standards:

D 1192 Guide for Equipment for Sampling Water and Steam in Closed Conduits²

D 2777 Practice for Determination of Precision and Bias of Applicable Methods of Committee D19 on Water²

D 3370 Practices for Sampling Water from Closed Conduits²

D 3858 Test Method for Open-Channel Flow Measurement of Water by Velocity-Area Method²

D 4411 Guide for Sampling Fluvial Sediment in Motion³

2.2 ISO Standard:

ISO 555/2-1974 Liquid Flow Measurement in Open Channels—Dilution Methods for Measurement of Steady Flow, Part 2: Integration (Sudden Injection) Method.⁴

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 *automatic programmable sampler*—a portable device designed to collect sequential, discrete water samples representative of the water mixture moving in the river in the vicinity of the sampler at a single point in a cross section. Depending on the make and model of the device, water samples can be collected at equal or variable time intervals.

3.1.2 *centroid*—the center of mass of the dye response curve calculated as outlined by Parker and Hunt (1)⁵.

3.1.3 *depth-integrated sample*—a water sample collected in such a manner as to be representative of the water mixture moving in the river in the vicinity of the sampler at a single vertical in a cross section.

3.1.4 *dispersion*—the three-dimensional process of disseminating the dye within a river's waters.

3.1.5 *flow duration*—the percentage of time during which a specific discharge is equalled or exceeded.

3.1.6 *fluorometer*—an instrument that measures the luminescence of a fluorescent substance when subjected to a light source of a given wave length.

3.1.7 *injection site*—a study site where the tracer is to be introduced into a parcel of river water. This study site is usually a sufficient distance upstream of the study reach such that complete vertical and lateral mixing of the tracer in a parcel of river water has occurred before the water parcel's entry into the study reach.

3.1.8 *lateral dispersion*—the process of disseminating the dye within a river water's horizontal axis perpendicular to its

¹ This test method is under the jurisdiction of ASTM Committee D19 on Water and is the direct responsibility of Subcommittee D19.07 on Sediments, Geomorphology, and Open-Channel Flow.

Current edition approved June 10, 2003. Published August 2003. Originally approved in 1994. Last previous edition approved in 1998 as D 5613 – 94 (1998).

² *Annual Book of ASTM Standards*, Vol 11.01.

³ *Annual Book of ASTM Standards*, Vol 11.02.

⁴ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036.

⁵ The boldface numbers in parentheses refer to the list of references at the end of this test method.