



Standard Practice for Use of Distributed Optical Fiber Sensing Systems for Monitoring the Impact of Ground Movements During Tunnel and Utility Construction on Existing Underground Utilities¹

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1. Scope

1.1 This practice specifically addresses the means and methods for the use of distributed optical fiber sensors for monitoring ground movements during tunnel and utility construction and its impact on existing utilities.

1.2 This practice applies to the process of selecting suitable materials, design, installation, data collection, data processing and reporting of results.

1.3 This practice applies to all utilities that transport water, sewage, oil, gas, chemicals, electric power, communications and mass media content.

1.4 This practice applies to all tunnels that transport and/or store water or sewage.

1.5 This practice also applies to tunnels that carry the utilities in (1.3), water for hydropower, traffic, rail, freight, capsule transport, and those used for storage.

1.6 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.7 *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

[E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods](#)

¹ This test method is under the jurisdiction of ASTM Committee F36 on Technology and Underground Utilities and is the direct responsibility of Subcommittee F36.10 on Optical Fiber Systems within Existing Infrastructure.

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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.

[E2586 Practice for Calculating and Using Basic Statistics](#)

2.2 Other Standards:

[IEC 61753-1 Fibre Optic Interconnecting Devices and Passive Components Performance Standard—Part 1: General and Guidance for Performance Standards](#)³

[IEC 61757-1 Fibre Optic Sensors—Part 1: Generic Specification](#)³

[COST Action 299 “FIDES” Optical Fibres for New Challenges Facing the Information Society](#)⁴

[ITU-T G.652 Characteristics of a Single-mode Optical Fibre and Cable](#)⁵

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 *accuracy*—the closeness of the measured value to the true or the ideal value of the parameter being measured. Accuracy represents the difference between the measured result and the true value and is affected by both bias and precision.

3.1.2 *attenuation*—the decrease in power of a signal, or light wave, from interaction with the propagation medium. The decrease usually occurs as a result of absorption, reflection, diffusion, scattering, deflection, dispersion or resistance.

3.1.3 *attenuation budget (also called optical power dynamic range and link budget)*—the maximum cumulative one-way or two-way power loss between the interrogator and the measurement point that allows a measurement with a specified performance.

3.1.4 *bias*—the difference between the measured result after averaging and the 'true' value. The true value can be obtained either by measuring a reference standard maintained by the national standard organizations or by using a traceable measuring instrument.

3.1.5 *bofda*—Brillouin optical frequency domain analysis.

³ Available from International Electrotechnical Commission (IEC), 3, rue de Varembe, P.O. Box 131, CH-1211 Geneva 20, Switzerland, <http://www.iec.ch>.

⁴ For additional information, visit <http://www.cost.eu>.

⁵ Available from International Telecommunication Union (ITU), Place des Nations 1211, Geneva 20, Switzerland, <http://www.itu.int>.