



Designation: D5858 – 96 (Reapproved 2020)

Standard Guide for Calculating *In Situ* Equivalent Elastic Moduli of Pavement Materials Using Layered Elastic Theory¹

This standard is issued under the fixed designation D5858; 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 concepts for calculating the *in situ* equivalent layer elastic moduli can be used for pavement evaluation, rehabilitation, and overlay design. The resulting equivalent elastic moduli calculated from the deflection data are method-dependent and represent the stiffnesses of the layers under a specific nondestructive deflection testing (NDT) device at that particular test load and frequency, temperature, and other environmental and site-specific conditions. Adjustments for design load, reference temperature, and other design-related factors are not covered in this guide. The intent of this guide is not to recommend one specific method, but to outline the general approach for estimating the *in situ* elastic moduli of pavement layers.

1.2 This guide is applicable to flexible pavements and in some cases, rigid pavements (that is, interior slab loading), but is restricted to the use of layered elastic theory² as the analysis method. It should be noted that the various available layered elastic computer modeling techniques use different assumptions and algorithms and that results may vary significantly. Other analysis procedures, such as finite element modeling, may be used, but modifications to the procedure are required.

NOTE 1—If other analysis methods are desired, the report listed in Footnote 3 can provide some guidance.

1.3 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.

1.4 *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 appro-*

*priate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*³

1.5 *This guide offers an organized collection of information or a series of options and does not recommend a specific course of action. This document cannot replace education or experience and should be used in conjunction with professional judgment. Not all aspects of this guide may be applicable in all circumstances. This ASTM standard is not intended to represent or replace the standard of care by which the adequacy of a given professional service must be judged, nor should this document be applied without consideration of a project's many unique aspects. The word "Standard" in the title of this document means only that the document has been approved through the ASTM consensus process.*

1.6 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 ASTM Standards:⁴

- D653 Terminology Relating to Soil, Rock, and Contained Fluids
- D4123 Test Method for Indirect Tension Test for Resilient Modulus of Bituminous Mixtures (Withdrawn 2003)⁵
- D4602 Guide for Nondestructive Testing of Pavements Using Cyclic-Loading Dynamic Deflection Equipment
- D4694 Test Method for Deflections with a Falling-Weight-Type Impulse Load Device

¹ This guide is under the jurisdiction of ASTM Committee E17 on Vehicle - Pavement Systems and is the direct responsibility of Subcommittee E17.41 on Pavement Testing and Evaluation.

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² The concepts of elastic layer theory are discussed in Chapter 2 of *Principles of Pavement Design*, by E. J. Yoder and M. W. Witczak, published by John Wiley and Sons, Inc., 1975.

³ Corrections or adjustments and a complete discussion of the use of each of these analysis methods with different NDT devices may be found in: Lytton, R. L., Germann, F. P., Chou, Y. J., and Stoffels, S. M., "Determining Asphalt Concrete Pavement Structural Properties by Nondestructive Testing," *NCHRP Report No. 327*, National Cooperative Highway Research Program, 1990.

⁴ 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.

⁵ The last approved version of this historical standard is referenced on www.astm.org.