



Standard Test Method for Fundamental Transverse, Longitudinal, and Torsional Resonant Frequencies of Concrete Specimens¹

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1. Scope *

1.1 This test method covers measurement of the fundamental transverse, longitudinal, and torsional resonant frequencies of concrete prisms and cylinders for the purpose of calculating dynamic Young's modulus of elasticity, the dynamic modulus of rigidity (sometimes designated as "the modulus of elasticity in shear"), and dynamic Poisson's ratio.

1.2 Values in SI units are the 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:

C 31/C 31M Practice for Making and Curing Concrete Test Specimens in the Field²

C 42/C 42M Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete²

C 125 Terminology Relating to Concrete and Concrete Aggregates²

C 192/C 192M Practice for Making and Curing Concrete Test Specimens in the Laboratory²

C 469 Test Method for Static Modulus Elasticity and Poisson's Ratio of Concrete in Compression²

C 670 Practice for Preparing Precision and Bias Statements for Test Methods for Construction Materials²

E 1316 Terminology for Nondestructive Examinations³

3. Terminology

3.1 *Definitions*—Refer to Terminology C 125 and the section related to ultrasonic examination in Terminology E 1316 for definitions of terms used in this test method.

4. Summary of Test Method

4.1 The fundamental resonant frequencies are determined using one of two alternative procedures: (1) the forced resonance method or (2) the impact resonance method. Regardless of which testing procedure is selected, the same procedure is to be used for all specimens of an associated series.

4.2 In the forced resonance method, a supported specimen is forced to vibrate by an electro-mechanical driving unit. The specimen response is monitored by a lightweight pickup unit on the specimen. The driving frequency is varied until the measured specimen response reaches a maximum amplitude. The value of the frequency causing maximum response is the resonant frequency of the specimen. The fundamental frequencies for the three different modes of vibration are obtained by proper location of the driver and the pickup unit.

4.3 In the impact resonance method, a supported specimen is struck with a small impactor and the specimen response is measured by a lightweight accelerometer on the specimen. The output of the accelerometer is recorded. The fundamental frequency of vibration is determined by using digital signal processing methods or counting zero crossings in the recorded waveform. The fundamental frequencies for the three different modes of vibration are obtained by proper location of the impact point and the accelerometer.

5. Significance and Use

5.1 This test method is intended primarily for detecting significant changes in the dynamic modulus of elasticity of laboratory or field test specimens that are undergoing exposure to weathering or other types of potentially deteriorating influences.

5.2 The value of the dynamic modulus of elasticity obtained by this test method will, in general, be greater than the static modulus of elasticity obtained by using Test Method C 469. The difference depends, in part, on the strength level of the concrete.

5.3 The conditions of manufacture, the moisture content, and other characteristics of the test specimens (see section on Test Specimens) materially influence the results obtained.

¹ This test method is under the jurisdiction of ASTM Committee C09 on Concrete and Concrete Aggregates and is the direct responsibility of Subcommittee C09.64 on Nondestructive and In-Place Testing.

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² Annual Book of ASTM Standards, Vol 04.02.

³ Annual Book of ASTM Standards, Vol 03.03.