
Standard Method of Test for

Vibrating Kelly Ball (VKelly) Penetration in Fresh Portland Cement Concrete

AASHTO Designation: TP 129-21 (2022)^{1,2}

Technically Revised: 2021

Reviewed but Not Updated: 2022

Editorially Revised: 2022

Technical Subcommittee: 3c, Hardened Concrete



**American Association of State Highway and Transportation Officials
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1. SCOPE

- 1.1. This test method describes the procedure for determining the consistency of fresh concrete by measuring the depth of penetration of a metal mass into plastic concrete under the force of gravity and quantitatively assessing the responsiveness to vibration of dry concrete mixtures, as is desired of a mixture suitable for slipform paving.
- 1.2. The values stated in either SI units or inch-pound units are to be regarded separately as the standard. Within the text, the inch-pound units are shown in brackets. The values stated in each system are not exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in nonconformance with the standard.
- 1.3. *The standard does not purport to address all 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 to determine the applicability of regulatory limitations prior to use.*
- 1.4. The text of this standard references notes and footnotes that provide explanatory information. These notes and footnotes shall not be considered as requirements of this standard.
- 1.5. *The quality of the results produced by this standard are dependent on the competence of the personnel performing the procedure and the capability, calibration, and maintenance of the equipment used. Agencies that meet the criteria of R 18 are generally considered capable of competent and objective testing/sampling/inspection/etc. Users of this standard are cautioned that compliance with R 18 alone does not completely assure reliable results. Reliable results depend on many factors; following the suggestions of R 18 or some similar acceptable guideline provides a means of evaluating and controlling some of those factors.*

2. REFERENCED STANDARDS

- 2.1. *AASHTO Standards:*
 - R 18, Establishing and Implementing a Quality Management System for Construction Materials Testing Laboratories
 - R 60, Sampling Freshly Mixed Concrete
- 2.2. *California Test Standard:*
 - CTM 533, Method of Test for Ball Penetration in Fresh Portland Cement Concrete
- 2.3. *Other Documents:*

- Koehler, E., and Fowler, D. *Summary of Concrete Workability Test Methods*. ICAR Report 105.1. University of Texas at Austin, Austin, TX, 2003.
- Wang, X., P. Taylor, and X. Wang. A Novel Test to Determine the Workability of Slipform Concrete Mixtures. *Magazine of Concrete Research*, Vol. 69, No. 6, 2017, pp. 292–305.

3. SUMMARY OF TEST METHOD

- 3.1. This test method comprises a two-part measurement to assess static and dynamic behavior of plastic concrete mixtures.
- 3.2. First, the consistency of fresh concrete is assessed by measuring the depth of penetration of a metal mass into concrete under the force of gravity.
- 3.3. Second, the rate of penetration of the metal mass under vibration energy of 98 J (72 lbf) at 8,000 vibrations per minute (vpm) is measured and recorded for up to 36 s. The rate of penetration in $\text{cm/s}^{1/2}$ ($\text{in./s}^{1/2}$) is determined and reported as the VKelly index. This parameter indicates the responsiveness of a mixture to vibration.

4. SIGNIFICANCE AND USE

- 4.1. This test method is intended to assess consistency and responsiveness to vibration of low slump concrete mixtures for applications such as slipform paving. Such a mixture should be mobile while under vibration, making it easy to move the mixture through a paving machine and to achieve full consolidation, but static and resistant to edge slump after the paver has moved on. The slump test only addresses the latter parameter. The approach here is to take the Kelly Ball test and modify it by adding vibration energy.
- 4.2. This test method is not considered applicable to non-cohesive concrete and maximum aggregate size greater than 37.5 mm (1.5 in.) or for mixtures with a slump greater than 75 mm (3 in.).

5. APPARATUS

- 5.1. *Equipment:*
 - 5.1.1. VKelly test apparatus is shown in Figure 1. The test apparatus is available in a kit from the National Concrete Pavement Technology Center. Alternatively, a Kelly Ball is commercially available. It will have to be modified to clamp the vibrator onto it, to add a graduated shaft, and to allow for the mass of the vibrator head. A frame is desirable to hold the system vertically during the test and to facilitate depth measurement.