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Standard Guide to Dimension Stone Test Specimen Sampling and Preparation[1]

This standard is issued under the fixed designation C1799/C1799M; 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.

ε[1] NOTE—The language in 8.1.2, 8.3, and 8.4 was updated editorially to be consistent with other sections in October 2022.

INTRODUCTION

Dimension stones are products of nature, and as such, are subject to the variability and unpredictability that is associated with all products harvested in nature. Testing of dimension stones to generate reliable data on which engineering decisions can be based has been a standard procedure in the industry for decades. The reliability of the data produced is largely influenced by the care and protocol used in obtaining and preparing the stone test specimens.

1. Scope

1.1 This guide covers sampling, selection, preparation, and conditioning of specimens that will be used to test material properties of dimension stone.

1.2 This guide sets forth basic recommendations for sampling and preparation of dimension stone test specimens and provides information regarding variables that should be considered.

1.3 This guide is intended to be used by architects, engineers, contractors and material suppliers who design, select, specify, install, purchase, fabricate, finish, or test natural stone products for construction applications.

1.4 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system are not necessarily exact equivalents; therefore, to ensure conformance with the standard, each system shall be used independently of the other, and values from the two systems shall not be combined.

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

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:*

C97 Test Methods for Absorption and Bulk Specific Gravity of Dimension Stone

C99 Test Method for Modulus of Rupture of Dimension Stone

C119 Terminology Relating to Dimension Stone

C120 Test Methods for Flexure Testing of Structural and Roofing Slate

C121 Test Method for Water Absorption of Slate

C170 Test Method for Compressive Strength of Dimension Stone

C217 Test Methods for Weather Resistance of Slate

C241 Test Method for Abrasion Resistance of Stone Subjected to Foot Traffic

C880 Test Method for Flexural Strength of Dimension Stone

C1352 Test Method for Flexural Modulus of Elasticity of Dimension Stone

C1353 Test Method for Abrasion Resistance of Dimension Stone Subjected to Foot Traffic Using a Rotary Platform Abraser

3. Terminology

3.1 Refer to Terminology C119.

3.2 *Definitions:*

3.2.1 *sample*—a small part or quantity of stone, usually a slab, panel, or ashlar, that is cut from a larger block of stone.

3.2.2 *specifying authority*—party requiring testing of dimension stone material.

[1] This guide is under the jurisdiction of ASTM Committee C18 on Dimension Stone and is the direct responsibility of Subcommittee C18.08 on Selection of Dimension Stone.

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3.2.3 *specimen*—an individual piece of stone that is cut from a sample to be used for physical or mechanical testing.

4. Significance and Use

4.1 The purpose of testing dimension stone is to quantify the various material properties of the stone. The test should consistently predict performance of the stone in a specific application. Many of the test methods that have been developed are specific and attempt to approximate the anticipated behavior of the stone in the manner that is intended to be used, such as flexural strength, compressive strength, and anchor strength. Other test methods provide general information about the stone, such as absorption and density. Test data provides the designer with information required to produce rational designs and assess if the stone will perform adequately for its intended use.

5. Selection Considerations

5.1 Natural stone test specimen selection is complicated by the anisotropic structure of most dimension stone. The term "rift" is used to describe the direction along which a dimension stone is most easily split. In some stone species, specifically the sedimentary stones such as limestone, sandstone and travertine, the rift direction and associated behavior can be pronounced, and is typically coincident with the natural bedding planes visible in the stone deposit.

5.2 Within the stone quarry, the in-situ orientation of these bedding planes may follow horizontal, mountain slope, or random directional trends. In other stone species of metamorphic or igneous origin, the presence of rift and, therefore, the anisotropy of the stone, tends to be milder. Exceptions to this rule are common, and stones of any formation type can be extremely anisotropic to nearly isotropic in both visual and mechanical properties.

5.3 Historically, all stones were considered to have a weak and a strong direction relative to their rift or bedding plane direction, or both. Commercially, the terms "fleuri" and "vein" are used to describe slabs that are cut parallel or perpendicular, respectively, to the bedding planes (Fig. 1). Test procedures were written to address this directional specificity and required test specimens to be cut for parallel loading or perpendicular loading, relative to the rift of the stone. Specific to bending strength specimens, a perpendicularly loaded test specimen is one that has the rift planes roughly parallel to the largest face of the sample, while a parallel loaded test specimen is one that has the rift planes roughly parallel to the end planes of the test specimen (see Fig. 2). Generally, a stone will demonstrate its greatest strength in a perpendicularly loaded test specimen and its lowest strength in a parallel loaded test specimen. It may be possible to identify a third orientation, but since its strength would logically fall between the true parallel and true perpendicular orientations, it is not normally sampled.

5.4 The historic sampling procedures are obtainable when the fabricator of the stone has access to cubic blocks of the material. Slabs must be cut from two perpendicular faces of the block to establish the proper rift plane orientation in the test specimens. Two practical problems exist with this practice.

5.4.1 For visual or aesthetic reasons, or both, many different types of stone are only sawn in one direction. If the slabs are only to be supplied in one direction relative to the rift, then testing in the other direction may produce data of no practical value and simply add unnecessary expense to the project.

5.4.2 Many materials are imported in slab form only, in which case the fabricator does not have access to cubic form quarry blocks from which the correct orientations can be obtained.

5.4.2.1 In such cases, the common practice is to prepare the test specimens from the slabs as provided from the fabricator, rotating the primary axis of the test specimen 90 degrees in the layout of the slabs so half of the test specimens are in an orthogonal relationship to the other half of the test specimens (Fig. 3).

5.4.2.2 Such specimens should not be referenced as "parallel" and "perpendicular" because they are not of true parallel and perpendicular rift orientation. The correct nomenclature to describe this sampling protocol would be "North-South" and "East-West", or "Major Axis" and "Minor Axis" specimens.

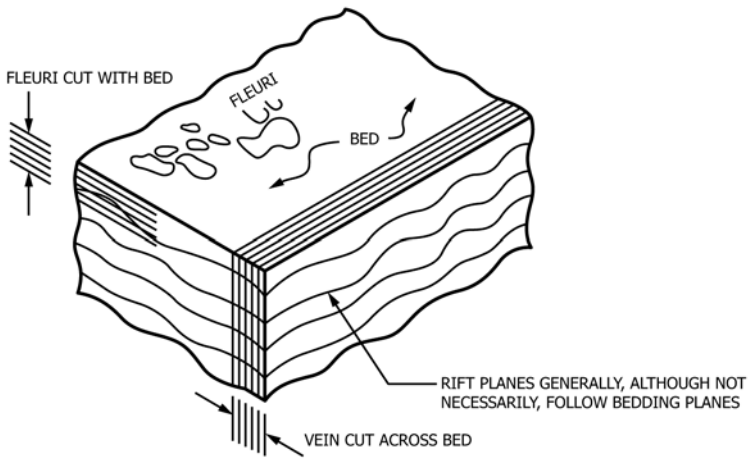

FIG. 1 Fleuri and Vein Cut Slabs