Designation: ~~E2751 – 12~~ E2751/E2751M – 13

Standard Practice for Design and Performance of Supported Laminated Glass Walkways[1]

This standard is issued under the fixed designation ~~E2751;~~E2751/E2751M; 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 practice addresses elements related to load-bearing glass walkways, glass treads, and glass landings constructed with laminated glass. This standard includes performance, design, and safe behavior considerations. It addresses the characteristics unique to glass and laminated glass. Issues that are common to all walkways, such as slip resistance, are addressed in existing referenced standards.

1.2 This practice does not address glass walkways constructed with monolithic glass, glass block, insulating glass units, glass tiles that are directly bonded to a non-glass structural substrate, or glass walkways intended to support vehicular traffic.

1.3 The values stated in either SI units or inch-pound units are to be regarded separately as ~~the~~ standard. The values ~~given in parentheses are for mathematical conversions to inch-pound units that are provided for information only and are not considered~~ stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the 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 appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

C1028 Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method

C1036 Specification for Flat Glass

C1048 Specification for Heat-Strengthened and Fully Tempered Flat Glass

C1172 Specification for Laminated Architectural Flat Glass

E631 Terminology of Building Constructions

E1300 Practice for Determining Load Resistance of Glass in Buildings

F609 Test Method for Using a Horizontal Pull Slipmeter (HPS)

2.2 *ANSI Standards:*[3]

ANSI/ASSE TR-A1264.3-2007 ANSI Technical Report, Using Variable Angle Tribometers (VAT) for Measurement of the Slip Resistance of Walkway Surfaces

2.3 *UL Standards:*[4]

UL 410 Standard for Safety for Slip Resistance of Floor Surface Materials

3. Terminology

3.1 *Definitions*—For definitions of general terms related to building construction used in this practice, refer to Terminology E631.

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[1] This practice is under the jurisdiction of ASTM Committee E06 on Performance of Buildings and is the direct responsibility of Subcommittee E06.56 on Performance of Railing Systems and Glass for Floors and Stairs.

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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.

[3] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.

[4] Available from Underwriters Laboratories (UL), 2600 N.W. Lake Rd., Camas, WA 98607-8542, http://www.ul.com.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *duration of load*—the period of continuous application of a given load, or the aggregate of periods of intermittent applications of the same load.

3.2.1.1 *Discussion*—

Any load duration longer than one hour shall be considered a permanent load. Uniformly distributed live loads shall have a load duration of at least one hour. Concentrated live loads shall have a load duration of at least ten minutes.

3.2.2 *ethylene vinyl acetate (EVA) interlayer*—co-polymer of ethylene and vinyl acetate used to permanently bond two or more lites of glass.

3.2.3 *glass-clad polycarbonate laminate*—assembly consisting of two or more lites of glass and one or more sheets of polycarbonate bonded by interlayers.

3.2.4 *ionomer interlayer*—a partially neutralized copolymer of ethylene and acrylic or methacrylic acid, used to permanently bond two or more lites of glass.

3.2.5 *laminated glass*—an assembly consisting of two or more lites of glass bonded by an interlayer.

3.2.6 *liquid resin interlayer*—liquid formulations, generally polyester-, urethane-, or acrylic-based, that react to form solid interlayers after being introduced between two lites of glass.

3.2.7 *polyurethane interlayer*—polymer sheeting based on isocyanates and mostly polyester or acrylic polyols, or both.

3.2.8 *polyvinyl butyral (PVB) interlayer*—polymer sheeting prepared from polyvinyl alcohol by reaction with butyraldehyde used to permanently bond two or more lites of glass.

3.2.9 *post-breakage glass retention*—the ability of the broken glass to remain in place so as to reduce cutting and piercing injuries from the broken shards and to prevent fall through or glass fallout.

3.2.10 *slip resistant*—the provision of adequate slip resistance to reduce the likelihood of slip for pedestrians using reasonable care on the walking surface under expected use conditions.

3.2.11 *supported glass walkway*—any glass walkway with a free spanning section, including continuous or local multiple supports at the edge or any location of the glass.

3.2.12 *walkway surfaces*—interior and exterior walking surfaces constructed and intended for pedestrian use, including but not limited to floors, ramps, sidewalks, and stair treads.

4. Significance and Use

4.1 Glass is a brittle material with different time and temperature-dependent properties than other solid materials used as walkways surfaces. Therefore, the type of glass is an important consideration in the design and construction of glass treads and glass landings constructed with laminated glass.

4.2 Post-breakage glass retention is an important consideration in the design of a glass walkway system as a means of minimizing tripping, cutting/piercing injuries, or fall-through or fallout of the glass.

4.3 The structural design shall be confirmed by calculations by a licensed design professional in accordance with Section 5.

4.4 If testing is required (see 4.4.1-4.4.3) to verify post-glass breakage behavior of the glass walkway, the testing shall be in accordance with Section 6.

4.4.1 For laminates with two glass plies, verification testing is required.

4.4.2 For laminates with more than two glass plies, verification testing is not required provided that calculations completed in accordance with 4.3 demonstrate that the glass assembly has sufficient strength to sustain the full design load with any one glass ply broken.

4.4.3 When verifying post-breakage behavior by calculation, allowable glass stress for 10 min load duration in accordance with Table 1 shall be used for all load cases.

4.5 The manufacturer or designer of glass walkway systems shall provide installation directions and fabrication and installation tolerances of their systems.

4.6 The structural integrity of the glass walkway system after glass breakage shall be sufficient to support the design loads after any one glass ply is broken. If damage of any kind occurs, the walkway shall be cordoned off and the installation shall be inspected to ensure structural integrity and pedestrian safety of the system.

5. Calculation Procedure

5.1 Use established engineering methods, such as engineering mechanics or finite element analysis, to determine glass assembly stresses and deflections. Such methods shall account for temperature, boundary conditions, loading requirements, load duration, interlayer properties, and glass strength.