



Standard Guide to Walkway Auditor Qualifications¹

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1. Scope

1.1 This guide outlines basic knowledge topics that walkway auditors should consider (where applicable) when conducting audits of pedestrian walkways.

1.2 *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

F2508 Practice for Validation, Calibration, and Certification of Walkway Tribometers Using Reference Surfaces

3. Terminology

3.1 *Definitions:*

3.1.1 *walkway tribometer, n*—any apparatus used to measure the frictional forces acting at an interface between a walkway surface and shoe material. **F2508**

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *walkway auditor, n*—a person competent to offer reliable observations and opinions regarding the conformance of an audited walkway to relevant safety guidelines or requirements.

3.2.2 *guiding document, n*—a standard, regulation, law, code, directive, statute, ordinance, or similar document that nominally limits, requires, or otherwise guides certain activities or conditions; the specific relevance or applicability of the document may vary.

4. Significance and Use

4.1 Characterizing the safety of a pedestrian walkway is a significant task, whether as a proactive effort or in response to

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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.

an incident. In addition to experience, the qualifications for a walkway auditor should include reasonable familiarity with guiding documents, sources for research, walkway tribometry, and walkway safety. This guide outlines topics for a walkway auditor training course intended to facilitate that familiarity.

4.2 As certain countries have codified requirements for the methods to be used in walkway auditing, it would be impractical to keep this guide current with those requirements. Though elements of practice in other countries may be similar, the focus of this guide is on the practice of walkway auditing in the United States.

4.3 Additional information is provided in **Appendix X1**.

5. Basic Knowledge Topics

5.1 *Goals and Terminology of Walkway Auditing:*

5.1.1 Use of terminology.

5.1.2 Pedestrian safety.

5.1.3 Incident investigation.

5.2 *Selected Information Sources:*

NOTE 1—Inclusion in this section does not imply applicability or relevance to a particular audit.

5.2.1 *Standards Development Organization Accrediting—ANSI: American National Standards Institute* (<http://www.ansi.org>).

5.2.2 *Standards Development Organizations:*

5.2.2.1 ASSE/ANSI: American Society of Safety Engineers (<http://www.asse.org>), A1264.2 Subgroup - Standards for Slip Resistance and Prevention of Slips, Trips and Falls.

5.2.2.2 ASTM International (<http://www.astm.org>), C21 Ceramic Whitewares & Related Products Technical Committee.

5.2.2.3 ASTM International (<http://www.astm.org>), D21 Polishes Technical Committee.

5.2.2.4 ASTM International (<http://www.astm.org>), F13 Pedestrian/Walkway Safety & Footwear Technical Committee.

5.2.2.5 ASTM International (<http://www.astm.org>), F15 Consumer Products Technical Committee.

5.2.2.6 ICC/ANSI: International Code Council (<http://www.iccsafe.org>), A117 Committee: Architectural Features and Site Design of Public Buildings and Residential Structures for Persons with Disabilities.

5.2.2.7 ICC: International Code Commission (<http://www.iccsafe.org>), Building Code Action Committee.

5.2.2.8 IESNA: Illuminating Engineering Society of North America (<http://www.iesna.org>).

5.2.2.9 NEMA/ANSI: National Electrical Manufacturing Association (<http://www.nema.org>), Accredited Standards Committee Z535 on Safety Signs and Colors.

5.2.2.10 NFPA: National Fire Protection Association (<http://www.nfpa.org>), Technical Committee on Fire Protection Features.

5.2.2.11 SAE: Society of Automotive Engineers (<http://www.sae.org>).

5.2.2.12 UL: Underwriters Laboratories (<http://www.ul.com>).

5.2.3 *State, County, and Local Guiding Documents:*

5.2.3.1 State, county, and local websites.

5.2.3.2 Municipal code publishers.

5.2.4 *U.S. Federal Government Guiding Documents:*

5.2.4.1 OSHA: Occupational Safety & Health Administration (<http://www.osha.gov>).

5.2.4.2 ADA: Americans with Disabilities Act (<http://www.ada.gov>).

5.2.4.3 Code of Federal Regulations (<http://www.gpo.gov/fdsys>).

5.2.4.4 Federal Register (<http://www.gpo.gov/fdsys>).

5.2.4.5 United States Code (<http://www.gpo.gov/fdsys>).

5.2.5 *Guiding Document Preambles and Archives.*

5.2.6 *Legal Resources and Case Law*—LexisNexis (<http://www.lexis.com>).

5.2.7 *Technical Publications and Journals.*

5.3 *Development Process for U.S. Standards.*

5.4 *Gait Mechanics and Traction Demand.*

5.5 *Fall Mechanics.*

5.6 *Walkway Design Characteristics:*

5.6.1 Facility design elements.

5.6.2 Means of egress.

5.6.3 Accessible routes.

5.6.4 Stairs.

5.6.5 Curbs.

5.6.6 Ramps.

5.6.7 Doorways.

5.6.8 Landings.

5.6.9 Walkway furnishings.

5.6.10 Contaminants.

5.6.11 Illumination.

5.6.12 Use of color and contrast.

5.7 *Walkway Material Characteristics.*

5.8 *Walkway Material Types:*

5.8.1 Manufactured.

5.8.2 Fabricated-in-place.

5.8.3 Natural.

5.8.4 Coatings.

5.9 *Carpet, Rugs, and Mats.*

5.10 *Maintenance.*

5.11 *Footwear.*

5.12 *Walkway Tribometry.*

5.13 *Correlation of Walkway Tribometer Testing to Human Subject Research.*

5.14 *Validation, Calibration, and Certification of Walkway Tribometers.*

5.15 *Conducting the Walkway Audit.*

6. Keywords

6.1 audit; pedestrians; slip resistance; tribometer; walkways

APPENDIX

(Nonmandatory Information)

X1. BASIC KNOWLEDGE TOPICS

X1.1 Goals and Terminology of Walkway Auditing

X1.1.1 *Use of Terminology*—Coefficient of friction, slip resistance, traction.

X1.1.2 *Pedestrian Safety*—Proactive audits, research.

X1.1.3 Incident investigation.

X1.2 Selected Information Sources

NOTE X1.1—Inclusion in this section does not imply applicability or relevance to a particular audit.

X1.2.1 *Guiding Documents from Standards Development Organizations:*

X1.2.1.1 *ASSE/ANSI:*³

(1) A1264.1 Safety Requirements for Workplace Walking/Working Surfaces and Their Access; Workplace Floor, Wall and Roof Openings; Stairs and Guardrails Systems

(2) A1264.2 Standard for the Provision of Slip Resistance on Walking/Working Surfaces

(3) TR-A1264.3 Technical Report: Using Variable Angle Tribometers (VAT) for Measurement of the Slip Resistance of Walkway Surfaces

X1.2.1.2 *ASTM C21²*—C1028 Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method

X1.2.1.3 *ASTM D21²*—D2047 Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine

X1.2.1.4 *ASTM F13:*²

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

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

(2) F1637 Standard Practice for Safe Walking Surfaces

(3) F1646 Standard Terminology Relating to Safety and Traction for Footwear

(4) F1694 Standard Guide for Composing Walkway Surface Investigation, Evaluation and Incident Report Forms for Slips, Stumbles, Trips, and Falls

(5) F2048 Standard Practice for Reporting Slip Resistance Test Results

(6) F2508 Standard Practice for Validation, Calibration, and Certification of Walkway Tribometers Using Reference Surfaces

(7) F2913 Standard Test Method for Measuring the Coefficient of Friction (Slip Resistance) of Footwear and Test Surfaces/Flooring Using a Whole Shoe Tester

X1.2.1.5 *ASTM F15*²—F462 Standard Consumer Safety Specification for Slip-Resistant Bathing Facilities

X1.2.1.6 *ICC/ANSI*³—A117.1 Accessible and Useable Buildings and Facilities

X1.2.1.7 *ICC*⁴—International Building Code

X1.2.1.8 *IES*⁵—LM-64 Photometric Measurements of Parking Areas

X1.2.1.9 *NEMA/ANSI*³

(1) Z535.1 Safety Colors

(2) Z535.2 Environmental and Facility Safety Signs

(3) Z535.3 Criteria for Safety Symbols

(4) Z535.4 Product Safety Signs and Labels

(5) Z535.5 Safety Tags and Barricade Tapes (for Temporary Hazards)

(6) Z535.6 Product Safety Information in Product Manuals, Instructions, and Other Collateral Materials

X1.2.1.10 *NFPA 101*⁶—Life Safety Code

X1.2.1.11 *SAE J185*⁷—Access Systems for Off-Road Machines

X1.2.1.12 *UL 410*⁸—Test Method for Measuring Wet SCOF of Common Hard-Surface Floor Materials

X1.2.2 *State, County, and Local Guiding Documents:*

X1.2.2.1 *Municipal Code Publishers:*

(1) Municipal Code Corporation (<http://www.municode.com>)

(2) Walter H. Drane Company (<http://www.walterdrane.com>)

(3) American Legal Publishing Company (<http://www.amlegal.com>)

(4) General Code (<http://www.generalcode.com>)

(5) Coded Systems LLC (<http://www.codedsystems.com>)

X1.2.3 *Selected U.S. Federal Government Guiding Documents:*

⁴ Available from International Code Council (ICC), 500 New Jersey Ave., NW, 6th Floor, Washington, DC 20001, <http://www.iccsafe.org>.

⁵ Available from Illuminating Engineering Society (IES), 120 Wall Street, Floor 17, New York, NY 10005, <http://www.iesna.org>.

⁶ Available from National Fire Protection Association (NFPA), 1 Batterymarch Park, Quincy, MA 02169-7471, <http://www.nfpa.org>.

⁷ Available from SAE International (SAE), 400 Commonwealth Dr., Warrendale, PA 15096-0001, <http://www.sae.org>.

⁸ Available from Underwriters Laboratories (UL), 2600 N.W. Lake Rd., Camas, WA 98607-8542, <http://www.ul.com>.

X1.2.3.1 *OSHA*⁹—29 CFR 1910 Subpart D, Subpart E

X1.2.3.2 *ADA*:¹⁰

(1) Standards for Accessible Design: 28 CFR 36

(2) Standards for Transportation Facilities: 49 CFR 37

(3) Standards for Transportation Vehicles: 49 CFR 38

(4) Standards for Passenger Vessels: 49 CFR 39

X1.2.4 *Guiding Document Preambles and Archives:*

X1.2.4.1 U.S. Federal Government guiding documents: notices of proposed rulemaking, public comment periods, directives.

X1.2.4.2 State, county, and local guiding documents: jurisdictional variations, multi-entity control.

X1.2.4.3 Consensus standards: access to deliberation documents, ballots, minutes, correspondence.

X1.2.5 *Technical Publications and Journals:*

X1.2.5.1 Applied Ergonomics: Elsevier (<http://www.elsevier.com>).

X1.2.5.2 Ergonomics: Taylor & Francis (<http://www.tandf.co.uk>).

X1.2.5.3 Journal of Forensic Sciences: Wiley (<http://onlinelibrary.wiley.com>).

X1.2.5.4 Gait & Posture: Elsevier (<http://www.elsevier.com>).

X1.2.5.5 Human Factors - The Journal of the Human Factors and Ergonomics Society: Sage Publications (hfs.sagepub.com).

X1.2.5.6 International Journal of Industrial Ergonomics: Elsevier (<http://www.elsevier.com>).

X1.2.5.7 Journal of the National Academy of Forensic Engineers: National Academy of Forensic Engineers (<http://www.nafe.org>).

X1.2.5.8 Professional Safety: ASSE (<http://www.asse.org>).

X1.2.5.9 Safety Science: Elsevier (<http://www.elsevier.com>).

X1.2.5.10 Journal of Biomechanics: Elsevier (<http://www.elsevier.com>).

X1.2.5.11 Clinical Biomechanics: Elsevier (<http://www.elsevier.com>).

X1.3 Development Process for U.S. Standards

X1.3.1 Consensus development process: committee membership, balance, balloting, negative resolution.

X1.3.2 Selected types of standards: Guides, Practices, Specifications, Safety Standards, Technical Reports.

X1.3.3 Codification and incorporation by reference.

X1.4 Gait Mechanics and Traction Demand

X1.4.1 Locomotion, swing and stance phases.

X1.4.2 Traction demand, forces applied to walkway, utilized/required traction, available traction.

⁹ Available from Occupational Safety and Health Administration (OSHA), 200 Constitution Ave., Washington, DC 20210, <http://www.osha.gov>.

¹⁰ Available from U.S. Department of Justice, Disability Rights Section, 950 Pennsylvania Ave. NW, Washington, DC 20530, <http://www.ada.gov>.

X1.5 Fall Mechanics

X1.5.1 Same-Level Pedestrian Falls:

X1.5.1.1 Slip and fall: heel slip, toe slip, splits.

X1.5.1.2 Trip and fall.

X1.5.1.3 Stumble and fall.

X1.5.1.4 Ankle roll and fall: inversion, eversion, plantar flexion, dorsiflexion.

X1.5.2 Falls From Elevation:

X1.5.2.1 Stairs ascending.

X1.5.2.2 Stairs descending.

X1.5.2.3 Balconies, windows, landings, floor openings.

X1.6 Walkway Design Characteristics

X1.6.1 *Facility Design Elements*—Behavioral activity in the area, paths of travel, pedestrian load, adjacent uses, wall conditions, clarity of conditions, wayfinding, design impacts on attention/distraction, equipment and temporary installations.

X1.6.2 Means of Egress:

X1.6.2.1 Exit access, exit, exit discharge, public way.

X1.6.2.2 Other elements.

X1.6.3 *Accessible Routes*—Minimum widths, heights, and clearances, elevators, parking space access and loading zones, signage, assembly areas.

X1.6.4 Stairs:

X1.6.4.1 *Stair Geometry*—Width, riser height and tolerances, tread depth, open risers, nosings, traction.

X1.6.4.2 Short flight stair systems.

X1.6.5 *Curbs*—Height, placement, marking.

X1.6.6 *Ramps*—Curb ramps, detectible warnings, transverse slopes.

X1.6.7 *Doorways*—Thresholds, door opening direction, opening over stairs, door dimensions, closers, powered doors, elevator doors and thresholds.

X1.6.8 *Landings*—Size, elevation.

X1.6.9 Walkway Furnishings:

X1.6.9.1 *Handrails*—Height, separation, profile, continuity.

X1.6.9.2 *Guards and Toeboards*—Height, openings.

X1.6.9.3 Speed bumps, curb (wheel) stops, bollards.

X1.6.10 *Contaminants*—Types, sources, drainage.

X1.6.11 *Illumination*—Natural, supplemental (artificial), measurement.

X1.6.12 *Use of Color and Contrast*—Component material colors or patterns, use of coatings.

X1.7 Walkway Material Characteristics

X1.7.1 Surface roughness, asperities, mechanical and molecular bonding.

X1.8 Walkway Material Types

X1.8.1 *Manufactured*—Ceramic tile, composite tile, resilient sheet, brick, block, finished plank, carpet, grating, metal plates and other walking surface hardware, expanded metal, synthetic grass.

X1.8.2 *Fabricated-in-Place*—Concrete, liquid polymers, asphalt paving, unfinished plank.

X1.8.3 *Natural*—Slate, rock, stone, gravel, earth.

X1.8.4 Coatings:

X1.8.4.1 *Benefits and Disadvantages*—Cosmetic appearance, ability to clean walkway, reduction of traction.

X1.8.4.2 Varnishes, waxes and polishes, resilient polymers, acrylics, epoxies, traction additives.

X1.9 Carpet, Rugs, and Mats

X1.9.1 Backing, non-slip mats, securement, edges, condition, pile height, floor recesses.

X1.10 Maintenance

X1.10.1 *Janitorial*—Responsibilities, training, equipment used, products used, product labeling and instructions, methods, frequency of service, replacement of consumables, signage.

X1.10.2 Contaminant management.

X1.10.3 Industrial process considerations.

X1.10.4 Walkway material condition.

X1.11 Footwear

X1.11.1 *Structure.*

X1.11.2 *Heels:*

X1.11.2.1 *Materials*—TPR, PVC, rubber, leather.

X1.11.2.2 Identifying materials.

X1.11.2.3 Height, tread.

X1.11.3 *Sole Materials*—SBR, EVA, PVC, rubber, NBR, TPR, leather.

X1.11.4 Slip-resistant soles.

X1.11.5 Shoe testing.

X1.11.6 Barefoot pedestrians.

X1.12 Walkway Tribometry

X1.12.1 *Testfoot Materials*—Neolite, leather, shoe polymers, shoe heel samples.

X1.12.2 Dragsleds.

X1.12.3 Articulated strut tribometers.

X1.12.4 Pendulums.

X1.12.5 Limitations of walkway tribometers to reliably test certain walkway surfaces:

X1.12.5.1 Adhesion/Stiction.

X1.12.5.2 Hydroplaning and hydrodynamic squeeze-film issues.

X1.12.5.3 Contours.

X1.12.5.4 Ramps.

X1.12.5.5 *Solid Contaminants*—Rigid particulates, crushable bulk contaminants.

X1.12.5.6 Potential geometric limitations to field testing.

X1.13 Correlation of Tribometer Testing to Human Subject Research

X1.13.1 Powers et. al. research on reference surfaces in 2007 and 2010.

X1.13.2 Other research.

X1.14 Validation, Calibration, and Certification of Walkway Tribometers

X1.14.1 Manufacturer calibration.

X1.14.2 *Practice F2508*:

X1.14.2.1 Validation.

X1.14.2.2 Calibration.

X1.14.2.3 Certification.

X1.15 Conducting the Walkway Audit

X1.15.1 Case-specific limits to audit scope and reporting.

X1.15.2 Use of standard forms and Guide F1694.

X1.15.3 Auditor liability.

X1.15.4 Documenting technical foundations for opinions and interpretations of data.

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