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DESIGN DIRECTIVE

To: Distribution

From: Erik J. Stoothoff, P.E. *EJS*
Chief Engineer

Date: 9/18/2020

RE: Flooring Surfaces – Epoxy Terrazzo

This design directive is intended to consolidate, reiterate, supplement, and clarify the MBTA's flooring surface design approach, preferences, and requirements.

In the event that conditions warrant deviation from this directive, a design waiver signed by The Chief Engineer and department owning the scope of work will be required of the project.

Design Consultants shall design to standards as prescribed by Code. MBTA Standards shall apply only where Code does not address a topic or the MBTA requires a standard more stringent than Code. The more stringent shall always apply.

OBJECTIVE

Design for Flooring Surfaces for all new construction, repair or replacement projects shall follow standards that are consistent with MBTA's emphasis on safety and accessibility of our passengers and staff. As such, design shall prioritize safety, functionality and ease of maintenance over time.

CODES, STANDARDS AND POLICIES

- 780 CMR – Massachusetts State Building Code
- 521 CMR – Massachusetts Architectural Access Board
- US DOT ADA Regulations & Standards
- ASTM E303-93 (2018) – Standard Test Method for Measuring Surface Frictional Properties Using the British Pendulum Tester
- ANSI 137.1 – American National Standard Specifications for Ceramic Tile

DESIGN PRINCIPLES

General Notes

- ADA/MAAB Regulations and Standards shall be adhered to for all projects.
- More than one accessible path of travel should be provided between any two destinations within a station.
- The accessible pathway should be the shortest and most convenient pedestrian pathway in and around a station or stop, making it the preferred pathway for station users of all abilities.

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- Sight lines should be clear between ramps, elevators and stairs, platforms, and any elements of the path of travel.
- MBTA Project Manager and Chief Engineer's Office to review all flooring submittals.

Flooring Surfaces

- All interior station flooring surfaces shall be Epoxy Terrazzo [Terrazzo]. All terrazzo surfaces shall be sealed unless otherwise directed by MBTA.
- Terrazzo surfaces shall provide a minimum Dynamic Coefficient Of Friction [DCOF] consistent with recommendations from The Ceramic Tile Institute of America [CTIOA] and United Kingdom Slip Resistance Group [UKSRG]. Refer to chart in Appendix A for further information.
 - DCOF for walking surfaces shall be considered for both wet and dry surfaces and measured using the British Pendulum Test for pedestrian slip resistance.
 - Pendulum Test Values [PTV] that are considered "Low Slip Potential" are as follows
 - Level floors: PTV shall be no less than 36 under wet conditions
 - Sloped floors no greater than 1:12 ratio: PTV shall be no less than 43 under wet conditions
- Terrazzo surfaces shall also be measured using the BOT-3000 DCOF test, as required by ANSI 137.1. MBTA requires such test to register a minimum 0.6 DCOF under wet conditions.
- Prior to submittal, the contractor shall provide testing results with product submissions.
- Slip Resistant Abrasive Strips [Strips] are required for Terrazzo applications.
 - Strips shall be inlaid, cast-in-place and made of Aluminum Oxide or Silicon Carbide.
 - Strips shall be 3/8" or 1/2" wide.
 - For new installations, U-channels shall be used for casting abrasive aggregate fill. In cases where additional Strips are determined to be necessary after the terrazzo application has been completed, retrofitting by way of saw-cutting is acceptable.
 - Strips shall not rise more than 1/16" above the finished terrazzo.
 - Strips shall be installed after terrazzo has been sealed. For installations where terrazzo is to be sealed, then grinded down to create a better DCOF, strips shall be installed after grinding is completed.
 - Strips shall be inspected for integrity on an annual basis and replaced as needed.
- Strips shall be installed as follows:
 - Ramps – a maximum spacing of 4 inches between strips.
 - Strips shall be installed as such that they cover 24 inches of floor surface from the top edge of the ramp and 24 inches of floor surface from the bottom edge of the ramp.
 - Entry way – strips shall be placed every 4 inches, for a minimum distance of 6 feet beyond the entry door.
 - Bottom of stairs – strips shall be placed every 4 inches, for a distance of 24 inches from the bottom step.
 - Top of stairs – strips shall be placed every 4 inches, for a distance of 24 inches prior to the beginning of the first stair tread.
- Entryway Flooring Systems [EFS] such as recessed floor mats, recessed grills or grates shall be considered for all station entrances. Design and installation of EFS shall be coordinated with OCE, SWA and Engineering and Maintenance. EFS shall be installed as follows.
 - EFS shall cover a minimum of the first 6 feet of floor space, beginning from the door frame, at station entrances. EFS shall be at least as wide as the door(s) at station entrances.

- EFS system shall have a recessed basin, such that the EFS rises no more than 1/8” above the finished floor.
- Tile, brick, granite, or unit pavers will not be permitted to be incorporated as walking surfaces unless specifically directed to do so by the MBTA. At no point will the MBTA approve or issue waivers to install irregular, rough, tumbled brick, chamfered pavers or cobble like walking surfaces or plazas.
- For direction regarding tolerances on different slopes and surfaces, please refer to the SWA issued Directive – Design Tolerances for Ramps, Sloped walkways, Cross Slopes & Level Surfaces

In the event that conditions warrant deviation from this directive, a design waiver signed by the Chief Engineer, System-Wide Accessibility and the department owning the scope of work will be required of the project.

ADDITIONAL DESIGN GUIDANCE

Submittal of complete manufacturer's product data to MBTA for approval is required. This shall consist of complete product description and specifications, catalog cuts, and other descriptive data required for complete product use and information.

Provide samples of all materials to be exposed in the completed work.

APPENDIX – A

Floor Slip Resistance (COF) Lab Test	Status	Background	Description
British Pendulum Test (HB 198/AS 4586 or 4663-2013, CTIOA, EN 13036-4, TS 15676, EN 14231, ASTM E303)	Required by MBTA for Flooring Coefficient of Friction validation as Primary test. Refer to directives and specifications.	Dry and wet slip resistance appropriate to various conditions, e.g. pool deck, lobby, rest room, etc.	The most widely used slip resistance tests worldwide. Endorsed by CTIOA since 2001.
ANSI A137.1 (aka “DCOF AcuTest”) DCOF Rating Test or ANSI A326.3	Accepted by MBTA for Flooring Coefficient of Friction validation as secondary test.	Specified in 2012 International Building Code for indoor wet areas. Uses BOT-3000E Tribometer. “DCOF AcuTest”.	Replaced ANSI B101.a and 101.3. Requires a 0.42 minimum “passing” value and more stringent sensor prep. MBTA requires passing value of 0.6.
Sustainable Slip Resistance Pendulum DCOF Test	Recommended for all existing floor surfaces for MBTA properties.	Check whether slip resistance survives after significant abrasive wear by pedestrians.	For areas with high pedestrian traffic that must remain slip resistant.
ANSI B101.3 DCOF Test	Not accepted by MBTA for Flooring Coefficient of Friction validation.	A recent U.S. standard using the BOT-3000E digital tribometer, mostly indoors. Based on slip and fall research.	Expired. No longer considered a valid standard.
ASTM C 1028-07 SCOF Test	Not accepted by MBTA for Flooring Coefficient of Friction validation.	Some specifiers still require it.	Obsolete, misleading test withdrawn by ASTM in 2014. Not valid for assessing pedestrian safety.
ANSI B101.1 SCOF Test	Not accepted by MBTA for Flooring Coefficient of Friction validation.	If required by specifier. Not a valid test for pedestrian safety, because it is a static test.	Expired. No longer considered a valid standard.
SlipAlert DCOF Test	Under review by MBTA. Not accepted at this time.	Qualitative demonstration that in some cases mimics pendulum readings.	A simple, durable machine is used that requires minimal training.
Tortus Floor Friction Digital Tribometer DCOF Test	Under review by MBTA. Not accepted at this time.	Dry and wet slip resistance up to high values of coefficient of friction with hard or soft rubber.	Endorsed by Ceramic Tile Institute of America since 2001.