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DESIGN DIRECTIVE

To: Distribution

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

Date: 4/20/2022

RE: Structural Decks

This design directive is intended to consolidate, reiterate, supplement, and clarify the MBTA's approach, preferences, and requirements for the design of structural decks. In the event that conditions warrant deviation from this directive, a design waiver signed by the Chief Engineer and the department owning the scope of work will be required.

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 above and beyond Code. The more stringent shall always apply.

DEFINITIONS

Elevated Walkways shall refer to structures designed to support pedestrian loads above grade, including: pedestrian bridges, ramps, overpasses, mezzanines, and plazas.

Facilities shall refer to all non-station building structures, including: maintenance buildings, office buildings, carhouses, ventilation buildings, repair shops, control towers, wayside platforms, and similar structures containing a deck.

Stay-In-Place (SIP) Forms shall refer to formwork most commonly made from corrugated metal used to place concrete decks and which are not stripped but remain in place for the life of the deck.

Steel Plate Decks shall refer to structural steel plate, normally more than 1/2 inch in thickness, which transmit dead loads and live loads to the supporting superstructure elements below without the use of any other structural deck material such as concrete. Most commonly steel plate decks are used to support ballasted track, however, examples of steel plate bridge decks supporting direct fixation track also exist within the MBTA system.

Structural Decks shall refer to structural elements which transmit dead loads and live loads to the supporting superstructure elements below, including: highway, railroad, and pedestrian bridge decks; elevated walkways decks; and floors for station and facility structures.

CODES AND STANDARDS

Unless noted, or directed otherwise, the latest edition of the following standards, codes and guidelines shall be used in the design of all bridge, elevated walkway, station, and facility decks, as appropriate, and as set forth in this directive.

- AASHTO Guide Specifications for LRFD Seismic Bridge Design
- AASHTO LRFD Bridge Design Specifications
- AASHTO LRFD Guide Specifications for Bridges Carrying Light Rail Transit Loads
- AASHTO LRFD Guide Specifications for the Design of Pedestrian Bridges
- AASHTO Standard Specifications for Highway Bridges
- AASHTO Standard Specifications for Transportation Material and Methods of Sampling and Testing
- ACI 302 Guide to Concrete Floor and Slab Construction
- ACI 318 Building Code Requirements for Structural Concrete
- ACI Manual for Concrete Practice
- AISC Code of Standard Practice for Steel Buildings and Bridges
- AISC Manual of Steel Construction
- AREMA Manual for Railway Engineering
- ASCE/SEI 7 Minimum Design Loads for Buildings and Other Structures
- AWS D1.5 Bridge Welding Code
- CMR 780 Massachusetts Station Building Code
- International Building Code
- MassDOT Engineering Directive E-12-002
- MassDOT LRFD Bridge Manual, Parts 1 and II
- MBTA Guide Specifications for Structural Design of Rapid Transit and Light Rail Structures
- NFPA 130 Standard for Fixed Guideway Transit Passenger Rail Systems

OBJECTIVE

To design resilient and serviceable infrastructure capable of maintaining state-of-good-repair condition with minimal maintenance.

DESIGN PRINCIPLES

1. Elevated Walkways: SIP forms shall be prohibited for use on all elevated walkways.
2. Highway Bridges: Use of SIP forms on highway bridges shall conform to MassDOT Engineering Directive E-12-002.

3. Railroad Bridges: Steel plate decks are strongly preferred over concrete decks on Railroad Bridges. Where concrete bridge decks are allowed, SIP forms are prohibited on all Railroad Bridges, including heavy rail, light rail, commuter rail, and freight. When used, steel plates shall have a minimum thickness of ½ inch, no steel plate use solely or as a deck component with a thickness dimension of less than ½ inch will be accepted regardless of design demand.
4. Stations: The use of SIP forms is prohibited at all stations regardless of ACI Exposure Classification.
5. Facilities: The use of SIP forms is prohibited in areas of facilities exposed to the conditions of ACI Exposure Class F1 (Exposed to cycles of freezing and thawing with limited exposure to water), ACI Exposure Classes F2 (freeze/thaw cycles with exposure to water) and F3 (freeze/thaw cycles with exposure to water and deicing chemicals).
6. Designers are encouraged to propose deck materials that are least affected by deicing chemicals, and systems and configurations that minimize or eliminate the need for deicing chemicals.
7. Where cast-in-place concrete is used in exterior applications, the project shall submit the mix design to MBTA QA/QC for approval. Concrete mixes shall be specifically designed for the very heavy salt application typically encountered on MBTA property. Concrete mix designs shall not consider any surface covering such as terrazzo, or other material.
8. Designers shall detail decks to promote drainage away from supporting structural elements.
9. Designers shall detail drainage components to ensure ease and accessibility of maintenance activities.