DESIGN DIRECTIVE

To: Distribution

From: Joseph A. Pavao, P.E.
Acting Chief Engineer

Date: January 6, 2023

RE: Pier Protection and Safety Walls

This design directive is intended to consolidate, reiterate, supplement, and clarify the MBTA's approach, preferences, and requirements for the design of pier protection and safety walls within commuter rail and rapid transit right-of-way. 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 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 above and beyond Code. The more stringent shall always apply.

DEFINITIONS

DESIGN VEHICLE shall be as specified in the *MBTA Guidelines for Load Rating Bridges,* or as specified by the Vehicle Engineering Department for new fleet vehicles or work cars, at maximum crush load (AW3 capacity). The designer shall select the vehicle type, applicable to the transit line, which produces the worst-case loading conditions.

PIER PROTECTION shall refer to the reinforced concrete structural elements designed to deflect commuter rail and/or transit vehicle derailment loads away from piers.

PIERS shall refer to structural elements supporting elevated rail, highway, and pedestrian bridges, including plazas and air rights developments.

SAFETY WALLS shall refer to reinforced concrete structural elements designed to deflect transit vehicle derailment loads away from primary station supports and other critical infrastructure as determined by the MBTA which do not meet the criteria of a pier as defined above.

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CODES AND STANDARDS

- *MBTA Railroad Operations Commuter Rail Design Standards Manual*
- *MBTA Maintenance of Way Division Book of Standard Trackwork Plans*
- *MBTA Guidelines for Load Rating Bridges*
- *MBTA Guide Specifications for Structural Design of Rapid Transit and Light Rail Structures*
- *AREMA Manual for Railway Engineering*

OBJECTIVE

To prevent catastrophic failure of elevated structures and damage to critical infrastructure in the unlikely event of rolling stock derailment.

DESIGN PRINCIPLES

1. Pier protection shall be provided in accordance with the requirements of the AREMA Manual for Railway Engineering.

2. Safety walls shall be used to protect primary station supports and other critical infrastructure located within 8-feet of the centerline of transit track. Consideration shall be given to protecting such elements located over 8-feet from the centerline of track as conditions warrant.

3. Safety walls shall extend to a minimum height of 4-feet above top of rail and shall be adequately anchored to substructure, extending at least 4-feet below surrounding grade.

4. Safety walls shall be designed for a horizontal derailment load equal to 40% of the design vehicle live load for a single car. This load shall act normal to the safety wall and shall be applied as a uniform load over a length of 10-feet and at a height of 2-feet above top of rail elevation. This load shall be considered at locations along the entire length of the safety wall.

5. Where application of derailment loads is not practical due to the presence of high-level concrete platforms, bridge guard, earthen berms, or other substantial structures, considerations may be made to ease these requirements. A design waiver for such cases shall be required.

6. Pier protection and safety walls shall be designed with a smooth and continuous face and must incorporate horizontal and vertical continuity to distribute the loads from the derailed train.

7. Pier protection and safety walls shall be provided with winged or angled sections at each end to deflect rolling stock away from blunt ends.