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DESIGN DIRECTIVE

To: Distribution

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

Date: June 5, 2020

RE: Overhead Contact System Pole Foundations

This design directive identifies the MBTA's requirements for the design of Overhead Contact System (OCS) Pole Foundations (collectively referred to herein as "Foundations"). In the event that conditions warrant deviation from this directive, the Engineer of Record shall submit a request for a waiver to the Chief Engineer.

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.

OBJECTIVE

The objective of this design directive is to clarify the MBTA's requirements for Foundations in an effort to provide a durable, reliable and maintainable foundation system for OCS poles and to ensure consistent design across the MBTA System.

CODES AND STANDARDS

Foundations shall be designed and installed per the requirements of the following:

- AREMA Manual for Railway Engineering
- ASCE 7 Minimum Design Loads and Associated Criteria for Buildings and Other Structures
- ACI 305 Hot Weather Concreting
- ACI 306 Cold Weather Concreting
- ACI 315 Details and Detailing Concrete Reinforcement
- ACI 318 Building Code Requirements for Structural Concrete
- ACI 336.3R Design and Construction of Drilled Piers

DESIGN PRINCIPLES

General Design

- Foundations shall have a minimum design life of 50-years.
- Foundations shall be designed with embedded threaded anchors for mechanically connecting foundations to OCS poles.
- OCS poles shall not be installed via direct implantation into native ground or “wet-set” into uncured concrete foundations.
- Foundations shall consist of cast-in-place reinforced concrete piers formed and poured within excavated pits or within drilled shafts.
- Foundations shall extend above grade by a minimum of 18 inches.
- Foundations and anchors shall be capable of supporting the loads incurred during construction and of withstanding a broken wire failure event without damage.
- Foundations shall be designed in a manner to minimize the types and sizes for simplifying constructability, to avoid disturbing existing adjacent structures, to provide flexibility for pole rake adjustment, and to minimize future maintenance.

Positioning

- Foundations shall be located on the field side of mainline track and not be placed between mainline tracks and be positioned so to provide a minimum 6” clearance from vehicle dynamic envelopes.
- Foundations located on station platforms shall be placed in a manner that minimizes passenger pass-by obstruction and visual impact, and shall be integrated with platform architectural design.

Foundation Stability

- Foundations shall be designed so not to overstress the ground material in which the foundation is installed.
- Appropriate allowable stresses shall be determined based on in situ soil/rock conditions.

Anchors

- Anchor bolts shall be cast-in-place and set by template.
- Anchor bolts shall conform to ASTM F1554.
- Nuts shall conform to ASTM A563.
- Washers shall conform to ASTM F436.
- Anchor bolts, washers, and nuts shall be hot-dip galvanized.

Grounding/Bonding

- Foundation design shall include a 10-foot ground rod with an insulated copper jumper cable exothermically connected to the steel reinforcement. An appropriate length of jumper shall extend out of the foundation to connect to the pole grounding stud.
- All grounding and bonding shall be tested after installation to verify the ground resistance.