Number: E-25-004
Date: 04/17/25

ENGINEERING DIRECTIVE

Carrie Lavallee, P.E. (signature on original)
CHIEF ENGINEER

Guidance for MassDOT Ancillary Structures Program

The purpose of this Engineering Directive is to define the objectives, scope and management of the MassDOT Ancillary Structures Program and provide initial guidance for the program. It is anticipated that this Engineering Directive will be superseded by a forthcoming *MassDOT Ancillary Structures Inspection Handbook*, updates to the *MassDOT Standard Specifications for Highways and Bridges*, updates to the *MassDOT Tunnel Inspection Handbook*, and other guidance. This Engineering Directive is effective immediately or by implementation timelines provided below and applies to MassDOT personnel as well as all current consultant contracts (including inspection) and construction projects not yet advertised for construction.

MassDOT Ancillary Structures Program

Program Objectives

- Maintain the safety of MassDOT facilities from hazards associated with ancillary structures
- Support full life cycle management of the inventory
- Perform regular inspections and maintain accurate asset information on inventory, condition, and maintenance history

Scope

MassDOT Ancillary Structures include light standards, traffic signal supports, support structures for Intelligent Transportation Systems (ITS), tolling gantries, and overhead highway sign support structures. Ground mounted signs with concrete foundation, breakaway connection base, and located within a distance less than its height from an adjacent roadway or sidewalk are also included. The inventory encompasses all MassDOT-owned structures and those owned by municipalities or private entities which are located within the state highway layout.

General Categories of MassDOT Ancillary structures are as follows:

- Intelligent Transportation System Support Structures (including Toll gantries.)
- Highway Lighting Structures

- Traffic Signal Structures
- Highway Signs and Support Structures

It is anticipated that additional categories will be added to the program in the future (e.g. culverts, dams, retaining walls, sound walls).

Management

Statewide management of the Ancillary Structures Program will be the responsibility of the MassDOT Bridge Section in Headquarters under the direction of the Statewide Ancillary Structures Engineer (ASE). Headquarters duties include establishment of Standard Operating Procedures, manuals, guides and specifications, management of ancillary structure data and information, management of consultant inspection contracts, monitoring and analysis of statewide inspection data for indications of systemic issues adversely affecting the inventory, and programming of capital projects.

The District Bridge Sections are responsible for day-to-day management of ancillary structures including oversight of State and consultant inspection teams, reviewing inspection reports, evaluating and prioritizing deficiencies, coordinating initial construction inspections and verifying and accepting repairs. The primary point of contact for all ancillary structure issues will be the District Ancillary Structure Engineer (DASE).

Guidance 1– Inspection Cycles of Ancillary Structures

All Ancillary Structures will begin transitioning into routine inspection cycles beginning 2024 according to the following schedule:

Structure Type	**Inspection Interval**	**Comments**
Lighting standards	4 Years	
Signal Structures (excluding mono-pole)	4 Years	
Mono-pole signal structures	8 Years	“Other” signals and RRFB’s
Sign, ITS & Tolling structures (span and cantilever)	4 Years	
Ground mounted signs	8 Years	Limited to signs w/concrete bases and break-away connections where the height of the sign is greater than the distance to the traveled way or sidewalk from the nearest support.

Guidance 2 – Reference to Ancillary Structure Numbers in Project Documents

MassDOT projects that include work on ancillary structures shall reference MassDOT structure identification numbers in project and contract documents. Existing structure numbers can be accessed from the MassDOT GeoDOT Site. Identification numbers for new structures can be requested by email through massdotancillarystructures@dot.state.ma.us.

As a final project deliverable, the designer shall provide a summary of all ancillary structure work in a table with the following format. The table should be included in the project submission and emailed to the address noted above.

Structure ID	Owner / Maintainer	City/Town	Category	Status	Latitude	Longitude
TBD	(E.G. DOT, Municipality)	(city/town name)	(ITS, SIGN, SIGNAL, LIGHTING)	(Proposed, modified, removed)	42.XXXX	-71.XXXX

Guidance 3 – Initial Inspections of new, replaced or repaired structures

The following guidance applies to all projects in progress as of the date of this Engineering Directive, and all future work on ancillary structures performed through construction, maintenance projects, accident recovery program (ARP), In-house repairs and applies to MassDOT and ancillary structures owned by others within the state highway layout (SHLO). Efforts needed to communicate MassDOT inspection policies and requirements to non-MassDOT owners are beyond the scope of this Directive and shall be addressed independently.

All new ancillary structures, replacement ancillary structures, or repairs to existing ancillary structures will be inspected through the Ancillary Structures Program. The Resident Engineer/ overseer of the work, regardless of the Section they work in, is responsible for requesting inspections through the DASE and include construction plans, specifications. The designer of record will forward approved shop drawings for all structures to massdotancillarystructures@dot.state.ma.us.

Construction inspections shall be performed sufficiently in advance of the contract completion date or acceptance date to allow for timely resolution of any deficiencies identified. At minimum, inspections shall be performed thirty (30) days prior to anticipated completion of the work for construction projects. For replacement/repair projects managed through Maintenance, ARP, or in-house forces, notification will be made ten (10) days prior to proposed construction. Inspectors shall provide a list of deficiencies (where identified) through the DASE to the Resident Engineer/overseer of the work within 10 days of completed inspection. It is the responsibility of the District Bridge Section to establish the criteria for verification and acceptance of said repairs. Once repairs are accepted initial construction reports will be updated and filed in 4D within 30 days. Inspections with no deficiencies will follow normal protocol and be completed within 30 days of the inspection end date.

Ancillary structures constructed through MassDOT projects and which are located outside of the SHLO and owned by Municipalities shall receive an initial inspection as described above with the following exceptions: Final reports will be forwarded to Construction in PDF format, archived with Construction records, and given to the owner; no follow-up routine inspections will be performed.

Guidance 4 – Anchor Bolt Inspection and Anchor Bolt Tightening Procedure for Ancillary Structures

The procedure described below shall guide the inspection, tightening and documentation of anchor rod nuts for various types of ancillary structures including Overhead Signs, ITS, Signals and Lighting. The *2021 AASHTO Ancillary Structures Inspection Reference Manual* and *MassDOT Standard Specifications for Highways and Bridges* should be used in conjunction with this document for additional guidance.

Sounding

Using a 1.5-lb ball-peen hammer, sound each anchor rod by striking the side of the top anchor rod nut to check for loose nuts (leveling and top). This action will result in a clanging sound and no movement of washers/nuts when sufficiently tight. Loose nuts will result in a dull sound.

Where loose nuts are suspected, do not immediately tighten the top nut. A loose leveling nut can also be the cause of the dull sound; Visually check for gaps between the leveling nut and the base plate. Tap one side of each washer above the leveling nut, placing one hand on the washer opposite the side being tapped. If the washer moves, the nut is not properly tightened. Physically grasp the washer and try to move it to determine the leveling nut tightness. For inspection purposes the difference between snug tight and fully tight will be difficult to differentiate without specialty equipment (see below for the definition of snug tight). If the leveling nut appears to be tight, proceed to tighten the top nut. Inspection of the leveling nut is not always possible due to grout pads. If this is the case, try to tighten the top nut as noted below. If the top nut cannot be tightened further, a more in-depth investigation is needed outside of this procedure.

Anchor rod nuts should be checked to see if they are frozen onto the anchor rod. This is particularly important when the nut is not at least snug tight. Frozen nuts can occur for various reasons however many are accelerated by the structure having a missing, broken, or damaged grounding; the use of non-galvanized components; and/or using dissimilar metals. If any of the above conditions are noted, a more in-depth investigation is needed outside of this procedure. Anchor rod nuts may also be immoveable due to anchor rod damage or plumbness. Any anchor rod that is damaged or out of plumb (slope > 1:40) should be noted in the inspection report (where appropriate).

Tightening

Anchor rod nuts should only be tightened with an appropriately sized socket, fixed or adjustable box style (crescent) wrench. While tightening, broken anchor rods can be identified as both the nut and the rod will turn with applied torque. If only the nut rotates under the applied torque, complete the tightening procedure noted below and again sound the side of the top nut and the top of the anchor rod with a hammer. Nuts should never be checked or

tightened with a pipe wrench as these are not designed to handle torque loading and can damage the nut. Note all nuts that required tightening in the inspection report (where appropriate).

Field inspectors should bring loose anchor rod nuts to a snug tight condition using Table 1 to determine the wrench length and pull force. Snug tight is defined herein as the maximum nut rotation resulting from the full effort of one person using a wrench which will meet or exceed 20% of verification torque without overtightening. The target torque range to tighten all loose nuts is between 20% and 50% of verification torque. Care should be taken not to exceed the upper 100% torque limit as this could damage the anchor rod and will not appreciably add strength or service life to the connection.

The following procedure will be used by field inspectors to bring accessible anchor rod nuts to at least a snug tight condition.

1. Clean and lubricate the exposed threads of the anchor rods.
2. If present and accessible, turn leveling nuts to bear on the bottom of the post base plate or the bottom of the base. Note if structural washers are in place and if the base plate or transformer base has either a standard circular hole, a slotted hole, or a tab. If there are slotted holes or tabs, flat washers (one washer corresponding to each anchor rod) are required per AASHTO. If a flat washer is not present, it should be noted as a deficiency.
3. Note if the top nuts have washers or bearing plates and if they are properly positioned. If not present, nuts should only be tightened to engage the base plate or transformer base and a maintenance recommendation should be generated. At no time should a nut that is engaged be removed without the pole and arm (if present) being supported by a secondary method.
4. Verify that the nuts can be turned onto the rods by the effort of one person using the wrench size prescribed in Table 1 (i.e., without employing a pipe extension on the wrench handle). If any nut is frozen apply MassDOT approved liquid penetrant prior to leaving the site.
5. Tighten top nuts to a snug tight condition. If more than one nut is loose, tighten each nut in a star pattern. A star tightening pattern is one in which the nuts on opposite or near-opposite sides of the anchor bolt circle are successively tightened in a pattern resembling a star (e.g., for an 8-bolt circle with anchor rods sequentially numbered 1 to 8, tighten nuts in the following bolt order: I, 5, 7, 3, 8, 4, 6, 2).
6. If present and accessible, tighten leveling nuts to a snug tight condition in a star pattern.

The approximate torque values given in Table 1 below represent 20% of the design torque. This is the minimum torque that must be achieved to ensure a snug tight condition as defined above. The intent of Table 1 is not to be exact but to achieve a target torque of 20% to 50% while not exceeding 100%.

e.g., To snug tighten anchor rod nuts for a 1-3/4" diameter anchor rod, Grade 55, an inspector would use an 18" long wrench, pulling on the handle with both arms in one smooth motion, with their full weight, until the anchor rod nut no longer turns. In this example, using Table 1, the calculated pull force needed to achieve the target torque of 20% to 50% is between 122 lbs. and 305lbs while not exceeding 610 lbs.

Table 1

Anchor Rod Diameter (in.)	Anchor Rod Grade (Yield Stress)					
	36		55		105	
	Wrench Length[1] (in.)	Approximate Torque lb.-ft	Wrench Length[1] (in.)	Approximate Torque lb-ft	Wrench Length[1] (in.)	Approximate Torque lb-ft
3/4	12[1]	9	12[1]	14	12[1]	26
1	12[1]	22	12[1]	33	12[2]	64
1-1/4	12[1]	44	12[2]	67	12[2]	128
1-1/2	12[2]	76	12[2]	116	21[2]	221
1-3/4	12[2]	120	18[2]	183	34[2]	349
2	17[2]	180	26[2]	275	60[2]	525
2-1/4	25[2]	261	39[2]	402	74[2]	768
2-1/2	35[2]	360	53[2]	550	101[2]	1050

[1] Use a 12" long wrench to snug tighten nuts by pulling on the handle with only one arm in a smooth motion until the anchor rod nut no longer turns.

[2] Use the wrench length specified in the table to snug tighten the nuts. Pull on the handle with both arms in one smooth motion, exerting the full effort of one person, until the anchor rod nut no longer turns.

Note 1: If the wrench used does not match the length specified in the table, adjust the grip distance from the anchor rod to replicate the effect of the specified wrench.

Note 2: If anchor rod grade is unknown use Anchor Grade 36 Column.

Guidance 5 – Use of Stockbridge-style Vibration Dampers on Overhead Sign Structures

This guidance prohibits use of Stockbridge-style vibration dampers on overhead sign structures.

New Installations

Effective immediately, Stockbridge-style vibration dampers are no longer considered a Department-approved damping device under Subsection 840 of the MassDOT Standard Specifications.

Existing Structures

Any Stockbridge-style dampers encountered on MassDOT-owned overhead sign structures during ancillary structure inspections shall be removed by the inspection team.

Inspections

Stockbridge style dampers removed during inspection shall be recorded in the report under element 2.15 as “N”, with remarks as: “Minor Maintenance, Stockbridge style damper removed (snipped) or (unbolted)”. The inspection report shall include before and after photos.

All monotube or dual tube “F style” cantilevered sign structures installed with Stockbridge-style dampers shall be inspected on a 2-year cycle with a focus on anchor bolts and post-to-arm connections.