

ENGINEERING DIRECTIVE

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CHIEF ENGINEER

Guidance for the Use of Adhesive Anchors

The Massachusetts Department of Transportation, Highway Division, maintains strict controls regarding the use of adhesive anchors in all applications. This Directive provides guidance and procedures to be followed for each potential use of adhesive anchors on MassDOT Highway Division facilities or on MassDOT Highway Division projects. The MassDOT Highway Division shall not permit the use of adhesive anchors in any application if the procedures in this Directive are not followed.

Potentially Acceptable Adhesive Anchors

- The Research and Materials Unit will maintain a list of products that have been tested in accordance with International Code Council Evaluation Service Acceptance Criteria 308 (AC 308) for creep susceptibility.
- Only those adhesive anchors that have been tested in accordance with AC 308 will be accepted.
- Use of “Fast Set” adhesive anchors is prohibited for ALL applications.
- The list of potentially acceptable adhesive anchors will be included on the Qualified Construction Materials List, which is available on the MassDOT website for Contractors, MassDOT personnel and other interested parties.

Guidance to Designers

- Designers shall always specify non-adhesive methods of anchoring dowels and other anchors into existing concrete, such as the use of cementitious grout in cored holes, except as provided below.
- Designers shall provide necessary dimensions for coring or drilling holes for the installation of dowels or anchors, including hole diameter and depth, spacing between dowels or anchors and edge distance.
- Designers shall not specify a non-adhesive material for anchor bolt applications that have been crash tested in accordance with NCHRP 350, such as attaching the S3-TL4 rails to the Highway Guardrail Transition as called for on the Construction Drawings or for anchor bolts that attach temporary precast concrete barriers to be used for stage construction, provided that the proposed system, including the adhesive, fully match what was used in the acceptance crash test.

Approval Process for Using Adhesive Anchors

Contractors may propose using adhesive anchoring material in lieu of what is specified on the Construction Drawings by following the approval process outlined below:

Step 1 – The Contractor shall prepare a written request to use adhesive anchors instead of coring and grouting. The request should address the following:

1. Is the change in the public interest?
2. Does it provide an equal or better material or product than originally specified?
3. Does it provide a better method of construction than originally planned?
4. If the Contractor benefits from the change, is there a corresponding benefit to the Department?

The request must identify the adhesive anchor material to be used and the exact application, including a detailed sketch or a copy from the Construction Drawings showing the exact location where the requested adhesive anchor is to be used, the spacing, edge distance, hole diameter and depth. In cases where multiple applications of adhesive anchors are proposed, each location will require a separate, use-specific request. The request shall be submitted to MassDOT through the Resident Engineer.

Step 2 – The District Construction Office will forward the request to the District Bridge Engineer (DBE) for a structural suitability review and approval.

Step 3 – The DBE will review the request in the following manner and in consultation with the Designer to obtain input into the design loads that the anchors or dowels must carry. If the DBE has any questions regarding the particular installation that do not fit the guidelines below, he or she shall contact the Boston Bridge Section for additional guidance.

Material Check

1. Is this a “Fast Set” adhesive? If yes, reject.
2. Is the adhesive on R&M’s approved list? If not, reject.

Prohibited Structural Applications: *Reject*

1. Overhead application – anchor is to be installed vertically upwards to suspend an object, such as a utility, directly from the anchor which will create a direct pull out tensile force.
2. Anywhere where the adhesive anchor based on structural behavior will be subjected to a constant tension load. This includes adhesive anchors that may carry large, intermittent but frequent tensile loads:
 - a. Reinforcing bars that need to develop the tensile component of moment from a beam or a column shaft or will always be subjected to a pull out tensile load from the member that they are anchoring to the existing concrete.
 - b. Abutment or wingwall stem reinforcing that is anchored into the footing and develops tension when holding back the backfill earth pressure.
 - c. Anchor bolts, such as anchor bolts for sign supports, strain poles, and luminaires that transmit moment to the concrete foundation.
 - d. Anchor bolts attaching brackets supporting utilities, where the bracket depth will create a moment couple between the anchor bolts so that the top bolt(s) will see a constant pull out load.
 - e. Permanent installations of precast concrete barrier to the bridge deck.

Permitted Structural Applications: *Approve*

1. Any application where based on a structural evaluation the anchor or reinforcing bar will be subjected only to shear forces without any tensile load component. These include:
 - a. Anchors used to attach utility brackets or supports that will carry the load in shear.
 - b. Reinforcing bars that act as dowels to transmit shear between concrete surfaces, such as across construction joints and between substructure elements.
 - c. Anchor bolts at abutments for bridge beams that will experience only shear and no uplift. (Drilling and grouting anchor bolts on piers is not allowed because of the potential to cut the primary pier cap reinforcing.)
2. Reinforcing bars that primarily act in shear but may be subjected to intermittent but infrequent tensile loads. This includes attaching new abutment caps and new wingwall caps provided that the bridge barrier reinforcing/railing anchor bolts will be developed in this cap, i.e. the barrier reinforcing is not what is being anchored to the existing concrete by the adhesive anchors.
3. Reinforcing that attaches new backwalls to existing abutment concrete since any tensile forces developed will be very low, the back wall is restrained by the backfill soil or the bridge superstructure. Also, if any longitudinal forces are developed, the load transmitted to the backwall will be resisted in part by the passive pressure of the backfill soil and hence the tensile loads on the reinforcing bars will be low.
4. The anchor bolts that attach the S3-TL4 rails to the Highway Guardrail Transition as called for on the Construction Drawings.
5. Anchor bolts that attach temporary precast concrete barriers that have been crash tested and accepted by FHWA to be used for stage construction, provided that the proposed system, including the adhesive, fully match what was used in the acceptance crash test.

Installation of the Proposed Adhesive

1. Does the edge distance and spacing of the anchors and the hole diameter and depth to be drilled meet or exceed the minimums as specified by the manufacturer? If not, reject.
2. According to the manufacturer's specifications, will the depth of the hole develop the required pull out or shear or combination of both of the anchor given the strength of concrete into which it is being installed? If not, reject.

Step 4 – Once the DBE determines whether a proposed adhesive anchor installation can be approved or must be rejected, he or she will notify the District Construction Engineer of the determination by memo (including all documentation included in the request) with a copy to the State Bridge Engineer and the Director of Research and Materials. If any of the application parameters are violated during construction in the field, the approval is null and void and a full reassessment is required.

Step 5 – The District Construction Engineer will request a final verification from the Director of Research and Materials to verify that the proposed adhesive anchor is still acceptable from a material standpoint for the proposed application. The Director of Research and Materials will initial the memo, stamp it REVIEWED, and send to the Resident Engineer for distribution

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