ADMINISTRATIVE INFORMATION:
- This Engineering Instruction (EI) is effective beginning with projects submitted for the lettings on or after September 1, 2019.
- This EI does not supersede any other issuance.
- The revisions issued with this EI will be incorporated into the Standard Specifications that will be published on September 1, 2019.

PURPOSE: This EI transmits revisions to Standard Specifications Section 586 Miscellaneous Structural Reconstruction.

TECHNICAL INFORMATION:
- Revisions have been made to Standard Specifications Section 586 Miscellaneous Structural Reconstruction in response to FHWA Technical Advisory T5140.34, Use and Inspection of Adhesive Anchors in Federal-Aid Projects, issued January 16, 2018.
- Permanent and temporary installations using §701-07 Anchoring Materials – Chemically Curing shall be designed using the current edition of ACI 318 for the given loading conditions. Effective September 1, 2019, all adhesive anchor installations that are structural in nature, both permanent and temporary, shall be installed by a certified ACI/CRSI Adhesive Anchor Installer.
- Temporary applications of adhesive anchors shall be inspected by the Contractor every 90 days at a minimum to ensure that the adhesive anchor is performing as intended.

TRANSMITTED MATERIALS:

BACKGROUND: In early August of 2007, the NTSB provided recommendations for the use of adhesive anchoring systems in highway construction, after completing a thorough investigation of the July 10, 2006 ceiling collapse in a portion of the Interstate 90 connector tunnel in Boston, Massachusetts. The NTSB strongly recommends that the FHWA and each State Department of Transportation prohibit the use of adhesive anchors in applications where failure could result in risk to the public. Since the original FHWA technical advisory was issued, two National Cooperative Highway Research Program (NCHRP) studies have been completed, and the industry and the American Concrete Institute (ACI) have made significant advancements on regulating adhesive anchor systems and installation. This EI reflects the most current understanding on the appropriate use of adhesive anchors.
This EI follows the requirements put forth by FHWA Technical Advisory T5140.34. The FHWA Technical Advisory T5140.34 requires adhesive anchor systems for new Federal-aid projects be qualified per ACI 355.4-11 or later editions. NYSDOT’s approved list for Anchoring Materials - Chemically Curing (701-07), Capsule & Pourable has been updated to only include those systems that are qualified per ACI 355.4-11.

REFERENCES:
NTSB Safety Recommendations H-07-23 and H-07-24 with supporting information are available at:

FHWA has issued Technical Advisory 5140.34 which is available at https://www.fhwa.dot.gov/bridge/t514034.pdf


CONTACT: Direct questions regarding this EI to Duane Carpenter of the Office of Structures via email at Duane.Carpenter@dot.ny.gov or at (518) 457-5715.
Incorporate the following changes into the Standard Specifications that will be effective on September 1, 2019:

Delete §586 in its entirety and replace it with the following:

586-1 DESCRIPTION
586-1.01 Drilling and Grouting Anchors. This work shall consist of drilling and grouting anchors. For the purposes of this specification, the term ‘anchors’ refers either to bolts or to reinforcing bars, as appropriate. When the item number indicates Pull-Out Testing is required, all anchors shall be paid for under that item number regardless of whether they are selected to be tested.

586-1.02 Removal of Rivets-Replacement with High Strength Bolts. This work shall consist of removal of rivets and replacement with high strength bolts.

586-1.03 Field Drill Holes in Existing Structural Steel. This work shall consist of field drilling holes in existing structural steel that is in service prior to the beginning of construction.

586-2 MATERIALS
586-2.01 Drilling and Grouting Anchors. Grout Material used in Permanent applications where a sustained tensile load will exist, shall conform to §701-05 Concrete Grouting Material. Grout used in other applications shall conform to either §701-07 Anchoring Materials - Chemically Curing or §701-05 Concrete Grouting Material. Chemically curing anchoring materials or adhesives are referred to herein as grout.

Permanent and temporary installations using Anchoring Materials – Chemically Curing shall be designed using the current edition of ACI 318 for the given loading conditions.

Anchoring Materials – Chemically Curing shall not be used in permanent applications where sustained tensile loads will exist, including but not limited to all horizontal or overhead applications, as well as all angles in between. Installation of anchors for Bridge railing, decorative railing, pedestrian fence and screening are not typically subject to sustained tensile loads. Some cantilever applications can produce sustained tensile loads, and chemically curing anchors shall not be used in these applications.

When such work is required, alternative anchoring methods or materials such as mechanical anchors or cementitious grouting operations shall be used in these locations. Use of alternate materials or methods not previously approved shall require approval of the Deputy Chief Engineer Structures (DCES).

Anchoring Materials – Chemically Curing may be used for temporary applications, as a part of a design sealed and signed by a Professional Engineer.

586-2.02 Removal of Rivets - Replacement with High Strength Bolts. High strength bolts, nuts and washers shall meet the requirements of §715-14 High Strength Bolts, Nuts and Washers. If paint color is not specified, the color selected shall match the existing paint. Paint shall meet the requirements of §708-02, Structural Steel Paint - Class 2.

586-2.03 Field Drill Holes in Existing Structural Steel. None Specified.

586-3 CONSTRUCTION DETAILS

586-3.01 Drilling and Grouting Anchors. All holes shall be drilled by means of a rotary impact drill. Except as indicated below, if reinforcing steel is encountered, the reinforcing steel shall be cut and removed by means of a core drill. The remainder of the drilling shall be done with the rotary impact drill. Where plans indicate significant design reinforcement, a non-destructive investigation shall be done to determine the location of existing reinforcing steel prior to drilling. If after the non-destructive
investigation, reinforcing steel is determined to be in conflict with, or encountered during the drilling operation, the DCES shall be notified to determine the appropriate course of action.

The Contractor shall not perform drilling with a lubricant, except in this case water is not considered a lubricant. Drilling methods shall not cause spalling, or other damage to concrete. Concrete spalled, or otherwise damaged by the Contractor’s operations shall be repaired at no additional cost to the State.

Holes shall be surface dry and shall have had all foreign and loose material removed immediately prior to grout placement. Prior to anchor placement in the grouted hole, all material which might interfere with bond between the anchor and the grout shall have been removed. This includes, but is not limited to: moisture, grease, dirt, mill scale and rust. Rust which cannot be removed from the anchor even by vigorous scrubbing with a wire brush is considered firmly bonded and may remain, unless more specific instructions are provided in the manufacturer’s installation procedures. The depth of hole and hole diameter shall be in accordance with the grout manufacturer's recommendation, and shall consider: anchor diameter, strength of existing concrete, anchor spacing and edge distance. The distance from the bottom of the hole to the nearest free surface of a structural element, shall be at least 1 5/8 inches or as recommended by the manufacturer, whichever is greater. The length of any plastic sleeve used as an aid to grout placement shall not be included in the length of the hole. The Contractor may increase the embedment length beyond that required by the contract documents if approved by the Engineer, at no additional cost to the State.

Grout shall be stored, mixed, and placed in accordance with the manufacturer's instructions. No grout shall be placed at a temperature outside the range recommended by the grout manufacturer.

Anchors shall be inserted full depth into the grouted hole and shall be manipulated or rotated in accordance with the Manufacturer's recommendations to ensure complete coverage of the embedded anchor with grout. After insertion of the anchor, all excess grout shall be struck off flush with the concrete face. Care shall be taken to prevent grout from running out of the drilled hole. Should the grout fail to fill the hole after anchor insertion, additional grout shall be added immediately after insertion of the anchor to allow a flush strike-off.

If the anchor is inserted in a hole with an axis that is predominantly horizontal, care shall be taken to prevent grout from running down the face of the concrete.

All uses of Anchoring Materials - Chemically Curing, both permanent and temporary, shall be installed by a certified ACI/CRSI Adhesive Anchor Installer.

Temporary applications using §701-07 Anchoring Materials - Chemically Curing shall be inspected by the Contractor every 90 days at a minimum to ensure that the adhesive anchor is performing as intended. The Contractor shall check for such things as creep of anchor material, movement of the anchors, loose bolts, loose nuts, etc. Temporary items anchored using §701-07 Anchoring Materials – Chemically Curing shall be removed or abandoned, in such a way that the anchors are no longer subject to any load upon completion of their temporary use.

**A. Anchor Pull-Out Testing.** Table 586-1 *Number of Anchors to be Pull-Out Tested* gives the number of anchors (N1) to be tested for any lot size. The Engineer will randomly choose the anchors to be tested. Testing of anchors in a lot shall not begin until all the anchors in the lot are installed. If one (N1) anchors fails, N2 indicates the number of additional anchors that must be tested. If only one anchor fails (N1+N2), the lot will be accepted. If more than one anchor fails, all remaining anchors must be tested.

A lot size is determined by the Contractor, but must meet the following criteria:

1. A lot size shall not exceed 600 anchors.
2. All anchors in a lot must be installed within a two-month period.
3. Any anchors installed beyond the two-month period set forth in 2 above shall be part of another lot.
4. A lot shall only include anchors grouted with a single product
5. A lot shall only include anchors of the same type, diameter and embedment depth.
Table 586-1 NUMBER OF ANCHORS TO BE PULL-OUT TESTED

<table>
<thead>
<tr>
<th>LOT SIZE</th>
<th>N1</th>
<th>N2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-30</td>
<td>All anchors in the lot</td>
<td>-</td>
</tr>
<tr>
<td>31-50</td>
<td>30</td>
<td>All remaining anchors</td>
</tr>
<tr>
<td>51-75</td>
<td>38</td>
<td>All remaining anchors</td>
</tr>
<tr>
<td>76-100</td>
<td>44</td>
<td>21</td>
</tr>
<tr>
<td>101-200</td>
<td>49</td>
<td>26</td>
</tr>
<tr>
<td>201-300</td>
<td>50</td>
<td>30</td>
</tr>
<tr>
<td>301-600</td>
<td>55</td>
<td>30</td>
</tr>
</tbody>
</table>

B. Test Equipment. The test equipment shall consist of a load cell, jacking system, a frame to distribute the jack load, couplers to connect the jack to the anchors, and appropriate safety devices. A calibrated pressure gauge with hydraulic ram is equivalent to a load cell. Prior to starting the testing, the Contractor shall supply the Engineer with a certificate of calibration for the load cell performed within the previous six months by an independent testing agency. Supports for the frame used to distribute the jack load shall be located outside a circle centered at the anchor. The circle shall have a diameter equal to 2 inches plus twice the anchor embedment length, but need not exceed 24 inches. The frame and jack shall be positioned so that the load is applied along the axis of the anchor. Chains or cables shall be used to connect the various pieces of the tensioning system so that free flying projectiles will not be created by the failure of an anchor coupling or other portion of the testing system.

C. Test Load. The test load for bolts shall be 90% of the ASTM proof load. When no proof load is given in the ASTM specifications for the bolt, the test load shall be the yield strength. The test load for reinforcing bar shall be 90% of the yield strength. Table 586-2, Anchor Pull-Out Test Loads lists the test loads for the most commonly used anchor bolts and rebar steels.

Table 586-2 ANCHOR PULL-OUT TEST LOADS

<table>
<thead>
<tr>
<th>Diameter (inches)</th>
<th>Test Load (kips)</th>
<th>ASTM A615 Grade 60 Reinforcing Bars</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Size</td>
</tr>
<tr>
<td>1/2</td>
<td>11</td>
<td>4</td>
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<tr>
<td>5/8</td>
<td>17</td>
<td>5</td>
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<td>3/4</td>
<td>26</td>
<td>6</td>
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<tr>
<td>7/8</td>
<td>35</td>
<td>7</td>
</tr>
<tr>
<td>1</td>
<td>46</td>
<td>8</td>
</tr>
<tr>
<td>1 1/8</td>
<td>51</td>
<td>9</td>
</tr>
<tr>
<td>1 1/4</td>
<td>65</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11</td>
</tr>
<tr>
<td></td>
<td></td>
<td>14</td>
</tr>
</tbody>
</table>

Note: this load testing is designed to be non-destructive. Loading shall be stopped as soon as the test load is reached.

Anchors pass if the specified test load is attained without permanently displacing the anchors. Concrete spalled or otherwise damaged by the load testing shall be repaired at no additional cost to the State. All anchors which fail a load test, or are otherwise damaged, shall be replaced at no additional cost to the State. All replaced anchors shall be successfully load tested.
586-3.02 Removal of Rivets - Replacement with High Strength Bolts. If the existing steel is painted, prior to the beginning of any other work operations, the paint shall be removed for a minimum distance of 4 inches on each side of the centerline of work location in accordance with the requirements of Section 574 Structural Steel Painting: Localized.

Rivets shall be removed by one of the following methods: Shear rivet head using a pneumatic rivet breaker (helldog), and drive out rivet shank with a pneumatic punch or flame cut rivet head above the base metal using a rivet scarfing tip without damaging the base metal, and drive out shank using a pneumatic punch. If punching will damage the base metal, the shank shall be removed by drilling. Any damage to the base metal shall be repaired at no additional cost to the State.

All high strength bolts shall be the same diameter as the rivets they replace. High strength bolts shall be installed after the nicks, burrs and foreign substances that might interfere with seating of the bolt head and nut washers are removed. Light grinding may be required. Installation and inspection of high strength bolts shall be performed in accordance with the Steel Construction Manual.

If it becomes necessary to disconnect, or adjust, steel remaining as part of the structure to complete the work, the Contractor shall obtain the Engineer's approval prior to performing disconnections or adjustments. If the bolt will not fit the rivet hole, the hole may be reamed sufficiently to accommodate the bolt.

If the contract does not include an item(s) for cleaning, priming and painting of structural steel, cleaning and painting of the bolt and immediate surrounding area shall be done as part of this work. Cleaning and painting shall be done in accordance with the requirements of Section 574 Structural Steel Painting: Localized. All steel exposed by the cleaning operations shall be painted, including at least 2 inches in every direction from the washer’s edge.

586-3.03 Field Drill Holes in Existing Structural Steel. If the steel is painted, prior to the beginning of any other work operations, the paint shall be removed for a minimum distance of 4 inches on each side of the centerline of work location in accordance with the requirements of Section 574 Structural Steel Painting: Localized. Any required re-painting will be paid for separately.

The required hole diameter will be indicated on the contract documents. The Contractor shall not flame cut, or flame drill holes. All damage to existing steel caused by the contractor’s operation, shall be repaired by the Contractor at no additional cost to the State.

586-4 METHOD OF MEASUREMENT

586-4.01 Drilling and Grouting Anchors. The quantity to be measured for payment will be the number of holes into which grout and bolts have been inserted.

586-4.02 Removal of Rivets - Replacement with High Strength Bolts. The quantity to be measured for payment will be the number of high strength bolts installed.

586-4.03 Field Drill Holes in Existing Structural Steel. The quantity to be measured for payment will be each hole drilled.

586-5 BASIS OF PAYMENT

586-5.01 Drilling and Grouting Anchors. The unit price bid for drilling and grouting anchors shall include the cost of all labor, materials, and equipment necessary to satisfactorily complete the work. The cost of new bolts and/or reinforcing bars will be paid for separately.
SECTION 586 - MISCELLANEOUS STRUCTURAL RECONSTRUCTION

586-5.02 Removal of Rivets - Replacement with High Strength Bolts. The unit price bid for removal of rivets and replacement with high strength bolts shall include the cost of all labor, material and equipment necessary to satisfactorily complete the work, including paint removal and painting. Payment will be made for each installed bolt regardless of whether a rivet was removed from the location.

586-5.03 Field Drill Holes in Existing Steel. The unit price bid for field drill holes in existing steel shall include the cost of all labor, equipment and materials necessary to satisfactorily complete the work, including paint removal when required. No additional payment will be made for holes drilled through different thicknesses, or through different numbers of plates.

Payment will be made under:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>586.0201</td>
<td>Drilling and Grouting Bolts or Reinforcing Bars</td>
<td>Each</td>
</tr>
<tr>
<td>586.0202</td>
<td>Drilling and Grouting Bolts or Reinforcing Bars (with Non-Destructive Investigation)</td>
<td>Each</td>
</tr>
<tr>
<td>586.0301</td>
<td>Drilling and Grouting Bolts or Reinforcing Bars with Pullout Test</td>
<td>Each</td>
</tr>
<tr>
<td>586.0302</td>
<td>Drilling and Grouting Bolts or Reinforcing Bars with Pullout Test (with Non-Destructive Investigation)</td>
<td>Each</td>
</tr>
<tr>
<td>586.0401</td>
<td>Drilling and Grouting Bolts, Overhead or Sustained Tension, with Pullout Test</td>
<td>Each</td>
</tr>
<tr>
<td>586.0402</td>
<td>Drilling and Grouting Bolts, Overhead or Sustained Tension, with Pullout Test (with Non-Destructive Investigation)</td>
<td>Each</td>
</tr>
<tr>
<td>586.05</td>
<td>Removal of Rivets- Replacement with High Strength Bolts</td>
<td>Each</td>
</tr>
<tr>
<td>586.10</td>
<td>Field Drill Holes in Existing Structural Steel</td>
<td>Each</td>
</tr>
</tbody>
</table>