# structural **PRACTICES** Federal Changes for Post-Installed Adhesive Anchors

By T. J. Bland, P.E.

The wheels of change turn slowly when it comes to government regulations. For federal highway infrastructure, some of the regulations for new construction have not been modified for decades, but developments in the past two years regarding the adhesive anchor industry are nothing short of a sea change. The most significant development was the issuance of a new technical advisory for bridges and structures by the Federal Highway Administration in January of 2018 (T5140.34). It establishes new guidelines for the installation and inspection of adhesives used in new and existing federal-aid projects. An additional development involves ongoing efforts by the federal government to strengthen the standards used under the Buy American Act. This article explains the recent history of state-by-state regulations in the industry, the review and adoption progress for the new regulations, and the significant impact of the developments on the formulation, specification, and use of anchoring adhesives.

The new technical advisory is the third advisory issued since the investigation into the 2006 ceiling panel collapse in the I-90 Seaport Connector Tunnel in Boston. The new advisory states that "since the original 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."

Industry efforts over the past 10 years have led to the new advisory, and it makes several recommendations.

#### Focus and Key Provisions

T5140.34 focuses primarily on structural connections that are under load. For new Federal-aid projects where post-installed adhesive anchors are deemed a necessity, they should be designed using the American Concrete Institute's ACI 318-14, *Building Code Requirements* for Structural Concrete, or later editions for the given loading condition (vertical, horizontal, or overhead) and use only adhesive anchor systems qualified per ACI 355.4-11, *Qualification of Post-Installed Adhesive* Anchors in Concrete, or later editions for the same loading condition.

For existing projects, where applications of post-installed adhesive anchors are under permanent sustained tension and where the adhesive anchor system was not specifically qualified for use under that loading per ACI 355.4-11 or later editions, the owner should either:

- 1) Institute a rigorous and regular inspection program that considers importance and redundancy to maintain an appropriate level of confidence in the long-term performance of these existing adhesive anchors. This may require developing a testing protocol and program to determine the site-specific ultimate capacities and creep characteristics of the adhesive over the expected life of the structure. Or,
- 2) Retrofit and/or replace the existing adhesive anchors with a post-installed mechanical anchor or post-installed adhesive anchor meeting the requirements of ACI 318-14/ACI 355.4-11 or later editions.

The rationale behind the decision can be found in the technical advisory, and the specific details can be found in the code itself. One of many key takeaways is that this technical advisory brings a federal requirement of a national standard, for the first time, to the use of post-installed adhesive anchors in roadways and structures – and it requires that each state abides by these standards. In short, adhesive anchors used in federally funded infrastructure projects must be approved to the same standards as adhesives specified in accordance with the *International Building Code* (IBC).

Some of the critical provisions of ACI 318-14 and ACI 355.4-11 that engineers and specifiers should be aware of include:

- The ACI and Concrete Reinforcing Steel Institute (CRSI) have established an <u>Adhesive Anchor Installer</u> certification program. The purpose of the program is to ensure uniformity in the knowledge base of those that install anchors on the parameters that may affect anchor performance, including hole drilling, hole cleaning, adhesive storage, adhesive mixing, and the importance of Manufacturer's Printed Installation Instructions (MPII).
- Installation of adhesive anchors horizontally or upwardly inclined (including vertically overhead) to support sustained tension loads shall be performed by personnel certified by an applicable certification program, such as the American Concrete Institute (ACI)/Concrete Reinforcing Steel Institute(CRSI) <u>Adhesive Anchor Installer Certification</u> program, or equivalent.
- ACI 318-14 requires continuous inspection of adhesive anchors installed in horizontal or upwardly inclined orientations to resist sustained tension loads, but it is left up to the owner to establish the inspector qualifications.
- ACI 318-14 establishes evaluation requirements under various adverse loading conditions, including sustained tension.

### State Adoption

Historically, individual states have maintained their own approval regulations for adhesive anchoring materials used on infrastructure projects. They kept their own authorized materials lists or approved products list, and the standards varied from state to state.

When T5140.34 was published in January 2018, only one state, Wisconsin, was requiring products tested following the building code

requirements. Adoption by other states has been limited, but this is not surprising, particularly if you understand the history within the industry.

The adoption of the new requirements varies from state to state and has been constrained by several factors.

First, some road and bridge officials may not be aware of the new standards – trends in adhesive anchoring are not exactly front-page news. Second, the amount of applicable federal work varies significantly from state to state. Large states, like Texas, have always had a robust system in place to monitor, approve, renew, and test products. Road construction is big business in Texas, so it is no surprise that it has already adopted specific classes of products that align with T5140.34.

Third, some states want to be sure that their published requirements are compliant with T5140.34 while also meeting other construction requirements that are unique to their state.

For example, Florida has its own anchoring testing because aggregate in the state is typically softer than in other parts of the country. For this reason, Florida developed its own creep test for anchoring. If a product is to be certified in Florida, it will need to meet state and federal standards (once they are officially adopted). While state-specific requirements might be delaying overall adoption, it is a positive thing when such requirements go above and beyond the federal requirements. Since January 2018, the following states have adopted the new requirements: Arizona, Iowa, Louisiana, Massachusetts, Michigan, Minnesota, New York, Oregon, Texas, and Wisconsin.

It is important to note that the remaining states are not sitting on their hands but are most likely in some stage of adopting the new standards. California, for example, announced in January 2020 that it will be sunsetting its legacy requirements on April 20, 2020, in favor of entirely new acceptance criteria, the first to require not only code approved products but also only those products that meet a specific minimum performance threshold. States that often follow California's lead will surely be next in line.

Smaller states, which do less federal road and bridge work, have been slower to adopt. In some instances, it is a question of staffing and prioritization. In other cases, smaller states follow the lead of neighboring states, which also may have not yet acted on the new requirements.

Another factor that should not be overlooked is the impact of T5140.34 on existing projects, which have both retrofit and inspection requirements. The ongoing cost associated with this type of inspection or retrofit should drive the specification for code-approved products by the engineers working at state Departments of Transportation (DOT) levels even before the state mandate for such products is drafted/ratified. Currently, engineers may already be specifying products that meet the intent of the federal regulations without being "told to do so" by their current state requirements. This may be another reason why adoption has been slow.

### The Buy American Act

The next significant development is the ongoing effort by the federal government to enforce and expand the Buy American Act, initially proposed by President Eisenhower in 1954.

The White House issued two executive orders in 2019 on this topic, both to enforce the Buy American Act "to the greatest extent permitted by law." In January of 2019, the executive order directed government agencies and departments to encourage recipients of federal project dollars to use products, of almost all kinds, that are produced in the United States.

It stated, among other points: "Within 90 days of the date of this order, the head of each executive department and agency administering a covered program shall, as appropriate and to the extent consistent with law, encourage recipients of new Federal financial assistance awards pursuant to a covered program to use, to the greatest extent practicable, iron and aluminum as well as steel, cement, and other manufactured products produced in the United States in every contract, subcontract, purchase order or sub award that is chargeable against such Federal financial assistance award."

The original 1954 Buy American Act considered a product "foreign" if the cost of the foreign products used in the materials constituted 50 percent or more of the total cost.

In the most recent executive order published in July of 2019, it lowers the threshold for steel to 5 percent or more. For all other end products, it lowers the cost to 45 percent or more. For products made in the adhesives industry, the majority of the cost must be paid in the United States, or the related projects will not qualify for federal money.

## Moving Forward

For engineers and specifiers, the most conservative route is to specify adhesive anchors that are manufactured domestically and meet the new federal requirement. Even though a majority of states have not yet strictly adhered to the new regulations, it is only a matter of time before there is widespread compliance. In conclusion, the new developments discussed in this article reinforce the importance of products that are both code-compliant and made in the USA.

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