$$\tau_{k\,(cr,uncr)} = t_{k,nom\,(cr,uncr)}\,\beta\,\alpha_{lt}\,\alpha_{st}\,\alpha_{dur}\,\alpha_{\varrho}\,\alpha_{conc}\,\alpha_{COV}\,\alpha_{cat3}$$

Equation 10-12 from ACI 355.4-19[7] for determining characteristic tension bond stress for cracked or uncracked conditions accounting for numerous reduction factors defined in text.

to determine the value of the characteristic design tension bond stress (τ_k) for cracked (*cr*) or uncracked (*uncr*) conditions using the equation shown above.

From this detailed evaluation process, it is clear that the design stress for the adhesive anchor system failing in bond is taken seriously. The design tension bond strength must also incorporate the appropriate ϕ-factor and any other modification factors as found in Section 17.4.5.2 and other provisions of Chapter 17 of ACI 318-14.

All the geometric requirements (such as edge distance, minimum anchor spacing, and concrete thickness) and installation recommendations for a specific concrete anchor or adhesive, plus the performance of the anchor in concrete breakout and pullout/pull through, and the steel strength, are summarized for the designer in a downloadable ESR from ICC-ES.

Part 3 of this four-part series on concrete anchors will focus on specifications and procurement of concrete anchors.

References

1. American Association of State Highway and Transportation Officials (AASHTO). 2017. *AASHTO LRFD Bridge Design Specifications*, 8th ed. Washington, DC: AASHTO.
2. American Concrete Institute (ACI) Committee 318. 2014. *Building Code Requirements for Structural Concrete* (ACI 318-14) *and Commentary* (ACI 318R-14). Farmington Hills, MI: ACI.
3. AASHTO. 2020. *Standard Specifications for Transportation Materials and Methods of Sampling and Testing*, 40th ed. Washington, DC: AASHTO.
4. AASHTO. 2018. *Standard Specification for Steel Anchor Bolts* (M 314-90). Washington, DC: AASHTO.
5. ACI Committee 318. 2002. *Building Code Requirements for Structural Concrete* (ACI 318-02) *and Commentary* (ACI 318R-02). Farmington Hills, MI: ACI.
6. ACI Committee 355. 2019. *Qualification of Post-Installed Mechanical Anchors in Concrete* (ACI 355.2-19) *and Commentary*. Farmington Hills, MI: ACI.
7. ACI Committee 355. 2019. *Qualification of Post-Installed Adhesive Anchors in Concrete* (ACI 355.4-19) *and Commentary*. Farmington Hills, MI: ACI.

PERSPECTIVE

A Call to Action for All Bridge Engineers

by Tim Keller, Ohio Department of Transportation

The article "Why Didn't They Just Close the Road?" in the Spring 2020 issue of *ASPIRE*® is a call to action for the bridge industry. One of the points of the article is that it takes strong leadership to make difficult decisions. Strong leadership, both politically and technically, must be evident for those affected to accept and understand the decision. The political leadership must have trust in the technical staff. "Trust is not given, but earned" is a statement that all bridge engineers should embrace. Trust is not given because of a person's title. Trust is earned over time as relationships are developed. Trust must exist before a crisis so that the "pushback" described in the article is not a roadblock or delay to a difficult decision. Trust must exist to push fear out of the decision process.

The concurring statement by National Transportation Safety Board (NTSB) vice chairman Bruce Landsberg on page 106 of the NTSB highway accident report on the 2018 pedestrian bridge collapse at Florida International University[1] should be read by everyone in the bridge industry. It stung the first time I read it. Powerful and basic, it is a call for our industry to learn from this failure. Elsewhere in the report, the NTSB issued recommendations specifically to the Federal Highway Administration (FHWA), Florida Department of Transportation (FDOT), American Association of State Highway and Transportation Officials, and the Engineer of Record. I believe these recommendations are meant for all of us in the industry.

My fellow state bridge engineers, as bridge owners, please join me in evaluating your state practices and processes with Landsberg's message in mind. You may find, as I did, that the complacency that he described has crept into some of your practices. With FHWA and our industry partners, we must continue to improve our specifications and the understanding on how to implement them. We all should take care that the training recommended in the accident report is not limited to how to make a shear calculation. The training we all are entrusted with is key to the future of bridge design. We have the responsibility to invest in people, so that future lessons learned are not a result of loss of life.

Reference

1. NTSB. 2019. *Pedestrian Bridge Collapse Over SW 8th Street, Miami, Florida, March 15, 2018*. Highway Accident Report NTSB/HAR-19/02 PB2019-101363. Washington, DC: NTSB. https://www.ntsb.gov/investigations/AccidentReports/Reports/HAR1902.pdf.