



Structures Engineering Instructions (SEI)

Distribution: Structures, Director PDD, Assistant Director PDD, PDD Section Managers, Chief of Contract Admin., Director Ops., Assistant Director Ops., Consultants

Approved: Wm. Michael Hedges **Date:** 12/17/07
Wm. Michael Hedges,
Structures Program Manager

Subject: **Use of Adhesive Anchors in Sustained Tension**

Administrative Information:

Effective Date: This SEI shall be effective for the Structures Section for all projects from the date of approval.

Superseded SEI: None.

Exceptions: None.

Disposition of SEI Content: The technical information transmitted by this SEI will be incorporated into the next revision of the Structures Manual.

Purpose:

To advise designers that anchor systems into concrete utilizing adhesives such as epoxy for permanent sustained tension load applications or for overhead applications is not allowed on VTrans Structures projects.

Technical Information:

The basis for this moratorium on the use of anchor systems utilizing adhesives is a technical advisory T 5140.26 issued by FHWA on October 17, 2007. The following is excerpted from the technical advisory:

- 1) On July 10, 2006, a portion of the suspended ceiling system of the I-90 connector tunnel in Boston, Massachusetts, collapsed onto a passing car killing the passenger and injuring the driver. The suspended ceiling in the collapsed section was comprised of concrete panels connected to steel hangers suspended from the tunnel concrete ceiling by an adhesive anchor system consisting of stainless steel anchor rods embedded in epoxy. Immediately after the accident, the Federal Highway Administration (FHWA) launched an independent study and testing plan to determine the probable cause of failure of the suspended ceiling system.
- 2) The testing plan consisted of short-term strength and long-term performance testing of the adhesive anchor system installed in the I-90 connector tunnel, as well as an experimental parametric study and a limited sustained load characterization study on the adhesive anchor system supplied for use in the I-90 connector tunnel conducted at the FHWA's Turner-Fairbank Highway Research

Center (TFHRC). The testing program identified several installation factors that affect the short-term strength of adhesive anchors. However, while these factors may have contributed to the timing of the failure, the results clearly show that the primary cause of the collapse was the use of Fast Set epoxy which is incapable of resisting sustained tension loads without excessive creep.

- 3) In addition to the testing conducted on the adhesive used in the I-90 tunnel, data produced at TFHRC show that some anchor systems utilizing adhesives other than Fast Set epoxy that have passed the International Code Council (ICC) creep certification process are still vulnerable to creep under typical bridge and tunnel exposure conditions. The results indicate that the current American Society for Testing and Materials (ASTM) and the ICC creep prediction methodology do not appear to guarantee safe performance of adhesive anchors over the entire expected service life (75 to 100 years) of transportation structures. In addition, the ICC does not address issues related to overhead installation of anchors nor the effect that vibration could have on their long-term performance and integrity.
- 4) Therefore, as a result of the investigation of the collapsed suspended ceiling support system, and in concurrence with the National Transportation Safety Board's findings, the FHWA is now implementing these safety recommendations to ensure that similar incidents will not occur in the future. This Technical Advisory applies to new and existing Federal-aid highway projects.

Sustained tension can be either direct tension such as utility supports anchored into the underside of a concrete bridge deck or indirect tension caused by prying action such as an overhead sign support anchored into a bridge deck fascia. This also applies to anchors or reinforcing steel subjected to direct sustained tension that is developed into existing concrete or rock substrates with adhesives.

Implementation:

The content of this SEI will be implemented immediately within the Structures section and shall be in effect until further notice.

Transmitted Materials:

FHWA Technical Advisory 5140.26 forwarded with this SEI.

Richard Tetreault, Director Program Development November 28, 2007 Directive