

## **EXECUTIVE SUMMARY**

At the request of the Georgia Department of Transportation (GDOT), Wiss, Janney, Elstner Associates, Inc. (WJE) has conducted an investigation of the partial collapse of the canopy structure on the 17th Street Bridge in Atlanta, Georgia. The collapse occurred on the evening of August 13, 2011 and affected approximately 190 feet of the 700 foot long canopy-fence structure along the south parapet of the bridge.

The supporting frames for the canopy-fence were comprised of built-up steel column and cantilever assemblies, attached to the outside face of the south concrete parapet using post-installed adhesive anchors. During the investigation, anchors within the collapse area were found to have pulled out from the concrete parapet. Vacated anchor holes were visually inspected, and epoxy samples from inside the holes were collected for materials testing. Epoxy was observed to vary in color and consistency at different locations, and at some locations, uncured and wet adhesive components were found. In addition to the epoxy samples, concrete core samples were taken from the south parapet for materials testing.

During the investigation, anchors away from the collapse area were observed to have measurable withdrawal from the parapet, indicating that long-term creep of the epoxy was a factor in the failure. In-situ load tests consisting of direct tension tests of existing anchor rods were performed on five anchors away from the collapse area in order to evaluate the performance of the adhesive anchors under short term tensile loading. Maximum applied loads ranged from 10,436 to 21,094 pounds, significantly exceeding the design tension service load of 4,000 pounds.

Structural analysis was performed to estimate the actual demands on the anchors during service. Due to the eccentricity of the cantilever arm supporting the overhead canopy relative to the anchor group, the adhesive anchors connecting the canopy support frames to the south parapet were subjected to sustained tensile loading. The sustained in-service tensile load at a typical lower anchor was calculated to be 1,053 pounds.

Based on the investigation, it was concluded that the canopy failure was the result of material and installation deficiencies. The primary cause of the collapse was the use of an epoxy anchor adhesive with poor resistance to long-term creep under sustained tensile loading. Other factors contributing to the collapse included disproportionate and incomplete mixing of the adhesive components and incomplete encapsulation of the anchors in the epoxy as indicated by voids and air pockets. Over time, the anchors connecting the supporting frames of the canopy to the south parapet of the bridge withdrew as the epoxy adhesive deformed and failed under a sustained tensile load that was substantially lower than the design service load.