# Structural Assessment of ASR/DEF-Affected Bridge Bent Caps

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## Summary

As part of a large-scale experimental study of ASR/DEF-affected bridge bent caps, the accuracy and conservatism of two structural assessment techniques were examined. The crack width summation and elastic rebound techniques were selected for their potential to provide fast, sufficiently accurate estimates of the expansion due to ASR/DEF. These expansion estimates are ultimately valued for their ability to provide clear insights into the behaviour of affected structures. Comparison of the estimates with measured expansions revealed that the crack width summation technique was best suited to the estimation of moderate expansion levels (above 0.2 percent). Conversely, implementation of the elastic rebound test resulted in excellent accuracy at low levels of expansion (below 0.2 percent). It is believed that further refinement of both techniques could lead to an invaluable pair of techniques for the practical assessment of ASR/DEF-affected structures.

**Keywords:** alkali-silica reaction; delayed ettringite formation; bridge bent caps; shear strength; structural assessment; crack width summation; elastic rebound testing.

## 1. Introduction

Population growth in the Houston metropolitan area outpaced the national average by nearly one hundred percent over the last two decades. The Texas Department of Transportation (TxDOT) was quick to respond, investing billions of dollars to rapidly expand Houston area infrastructure. While necessary, the accelerated pace of the expansion came at the expense of the long-term durability commonly associated with concrete construction in Texas. Unrestrained use of high-sack concrete mixtures resulted in elevated alkali loadings, high curing temperatures, and substantially increased chances for damage (illustrated in Figure 1) due to alkali-silica reaction (ASR) and/or delayed ettringite formation (DEF).

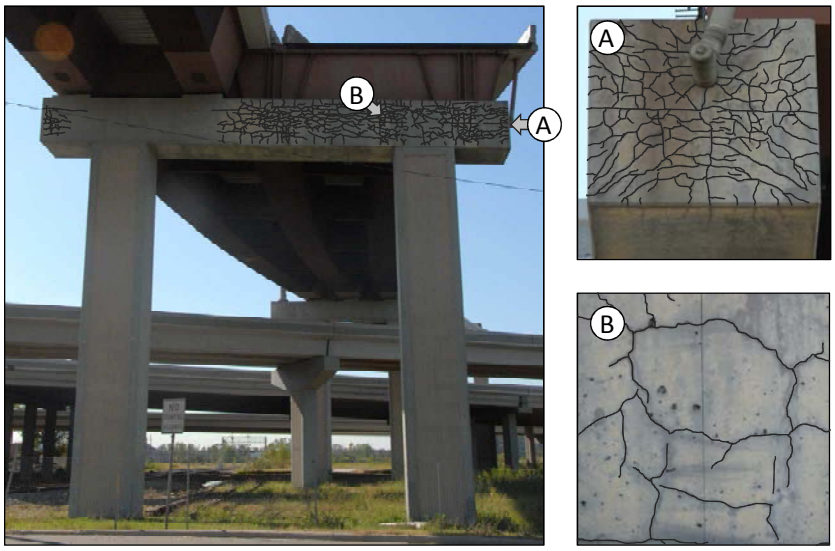


*Figure 1: Typical Field Damage (US-59 and I-10 Interchange in Houston, Texas)*

In 2008, TxDOT estimated that more than one billion U.S. dollars worth of Houston infrastructure had developed expansion and cracking characteristic of ASR/DEF deterioration. Assessment of the safety and service life consequences of the damage were difficult to define. ASR/DEF-related

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