

**SHEAR CAPACITY OF LARGE-SCALE BRIDGE BENT SPECIMENS
SUBJECT TO ALKALI-SILICA REACTION AND DELAYED ETTRINGITE FORMATION**

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ABSTRACT

In recent years, a number of reinforced concrete bent caps within the State of Texas have exhibited premature concrete damage from alkali-silica reaction (ASR) and/or delayed ettringite formation (DEF). Both deterioration mechanisms subject concrete to expansive forces, leading to map cracking, spalling, and a potential loss of strength. The visually alarming nature of the cracking has led the Texas Department of Transportation to evaluate the structural safety of the damaged bent structures so that appropriate repairs may be completed.

Due to the abnormal, highly differential expansions of ASR and DEF, the structural consequences are not immediately understood. A number of previous studies suggest that severe damage may result in a substantial reduction of structural capacity, requiring costly repairs and potential replacement. Others report little more than serviceability concerns that may be addressed with inexpensive remedial measures.

Assessment of the structural safety is further limited by a lack of structural tests performed on large-scale specimens representative of the damaged in-service bent caps. While a small number of full-scale tests have been completed on structural components taken out of service, much of the data reported is the result of small-scale studies. The substantial material and process inputs required in the production and testing of large-scale ASR/DEF specimens has historically precluded the development of such a laboratory program.

The inconclusive nature of the published literature and lack of representative specimens emphasized the need for a large-scale testing program. An experimental study is currently being carried out at Ferguson Structural Engineering Laboratory to evaluate the effect of ASR and DEF on the shear strength of large-scale reinforced concrete bent caps. Four near full-scale reactive specimens have been fabricated and are being held under conditions favorable to the development of realistic ASR and DEF damage. Upon attaining a representative level of expansion, shear testing will commence.

The challenges faced in fabricating and conditioning the bent cap specimens will be presented. Subsequent expansion and crack development will be reviewed and correlated with structural testing results.