**TPF-5(115) Blast Testing of Full-Scale, Precast, Prestressed Concrete Girder Bridges**

**Objectives:**  
The objectives of this research were: (1) to assess the damage done to precast, prestressed girder bridges from a blast generated below the girders, (2) to compare this damage with a blast generated on top of the bridge deck, and (3) to develop recommendations for possible mitigation measures that would harden this type of bridge blast damage.

Final Reports: The final reports have sensitive information and are available only by contacting the WSDOT Library at [library@wsdot.wa.gov](mailto:library@wsdot.wa.gov) or by phone at 360.705.7750.

**WA-RD 718.1 Explosive Tests of Precast, Prestressed Bridge Girders**

Abstract: The main objective of this test series was to gain a basic understanding of the vulnerability of precast, prestressed girder bridges to explosive loadings similar to those produced from the detonation of a vehicle bomb either on or below the bridge deck. These initial tests were conducted against individual girders in order to completely isolate their response from other variables. Future tests would incorporate complete bridge decks and thus more complex response modes. This data report provides details of the test setup, instrumentation, and data gathered.

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**WA-RD 718.2 Effects of Blast Loading on Prestressed Girder Bridges**

Abstract: Since the events of September 11th, more attention has been given to the effects of blast on structures. Bridges are especially important in this area due to their potentially critical role in the economy and for emergency response. Prestressed concrete bridges are very common, representing 40% of Washington’s state bridges and 11% of state bridges nationwide. Despite this, very little is known about how prestressed concrete bridges respond to blast loading. A finite element model of a precast, prestressed girder was created and validated with two empirical tests. It was found that for an explosive event above or below the girder, analytical and empirical results were consistent.

The girder model was expanded to a four-girder, simple-span bridge model. Four different scenarios were examined at the midspan of the bridge: a blast between two girders both above and below the deck, and a blast centered on a girder both above and below the deck. For the two load cases from above, a TNT equivalent of 250 pounds at a four-foot standoff distance was investigated. This load resulted in highly localized damage with the possibility for other sections of the bridge to be immediately reopened after the event. For the two load cases from below, a TNT equivalent of 500 pounds at a ten-foot standoff distance was investigated. Results indicate that the slab will be heavily damaged but the girders will remain intact.

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