In-Situ Diagnostic Load Testing

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Background:
Every year, numerous PC girder bridges are accidentally damaged by over-height vehicles or sometimes during site clean up. Considering that a girder may be significantly damaged due to impact, the repair alternative is to replace the damaged members of the bridge. The full replacement of damaged elements, although it could be effective, is typically an expensive solution and requires the closure of at least one traffic lane and, in case of an overpass, the road under the bridge, during the girder replacement. Strengthening using FRP laminates has emerged as an alternative to traditional materials and techniques (i.e. externally bonded plates, steel or concrete jacket and external post-tensioning).

Objectives:
To provide an experimental validation for one of the FRP-based strengthening techniques of PC girders. An experimental campaign was conducted to prove that CFRP upgrade technique allow to restore the ultimate flexural capacity of the undamaged member.

CFRP upgraded Specimen

Load vs Displacement plot for undamaged and damaged and CFRP upgraded specimens

Conclusions:
• The experimental results indicate that analytical models correspond well to the measured response from the field tests
• The laboratory work confirmed the validity of the proposed upgrade technique
• Test result show that is possible to use the FRP technique to upgrade PC beams with almost 17% of tendons lost without compromising the effectiveness of the upgrade system.
• Researches are currently in progress in order to optimize the U-wrap spacing and dimensions