

JOINT TRANSPORTATION RESEARCH PROGRAM

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Evaluation of Effects of Fire on the I-465 Mainline Bridges—Volume I

Introduction

On October 22, 2009, in Indianapolis, Indiana, a semi tanker carrying liquefied propane lost control on the underpass from I-69 southbound to I-465 eastbound, crashing beneath the eastbound and westbound bridges carrying mainline I-465 traffic. The semi rolled, causing the tractor to catch fire and the propane tanker to explode. As a result of the fire, the steel superstructure was subjected to extreme temperatures; however, the duration of exposure and magnitude of these temperatures was not accurately established. Thus, testing was performed to identify and document any short-term or long-term effects that the fire may have had on the steel superstructure. Three primary tasks were performed as part of the study:

1. Quantify the effects of the fire on the properties of the structural steel.
2. Quantify the effects of the fire on the properties of the high strength (HS) bolts.
3. Quantify the effects of the fire on the overall behavior of the bridge.

Findings

The results presented in this report show the following:

- The explosion and subsequent fire did not negatively impact the properties of the HS bolts.
- The explosion and subsequent fire did not negatively impact the properties of the steel in the main girders.

- The explosion and subsequent fire did not negatively impact the overall load distribution nor adversely alter the behavior of the bridge.
- Controlled test loading and long-term monitoring confirmed that the steel girders are acting compositely with the concrete deck.
- Based on the results of the long-term monitoring, infinite fatigue life is expected at all of the monitored locations.

Implementation

Although the investigation is very specific to this bridge, there are a few general points that can be gleaned. First, although the immediate fireball was spectacular, the hydrocarbon fuel burned very quickly and was of such short duration that the steel and HS bolts were not damaged. This may not have been the case if the truck had been hauling heavy fuel, such as diesel, gas, or another combustible material that burns more slowly. Thus, although visually the event appeared to be quite damaging (i.e., there was heavy soot deposited and a large fire ball), in this case there was no damage. Second, the immediate inspection that followed the event revealed that the paint, though covered in soot, was completely intact. The condition of the paint is a reasonable indicator of the temperature that the steel reached. Since the paint was not damaged, it suggests there were no detrimental effects on the steel, which turned out to be the case. Hence, if the fire event does not damage the paint, it would be reasonable to conclude that the steel properties are not altered.

Recommended Citation

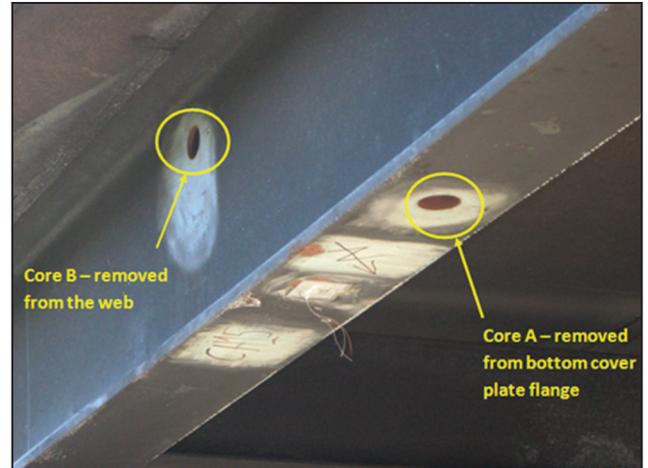
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Bearing that fell out during the crash (Beam #12; Bent #3) – Eastbound Bridge.



Cores removed from the web and bottom cover plate (Beam #11) – Westbound Bridge.