

# Repairing the Fire Damaged Thakaneng Bridge at the University of the Free State, Bloemfontein, South Africa

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## 1 Introduction

WSP were appointed to conduct a visual inspection of an existing bridge (The Thakaneng Bridge) which had experienced structural damage due to a fire which occurred in December 2022. The Bridge serves as a pedestrian link across DF Malherbe Avenue and consists of various delis and food stalls situated on the ground floor (top of deck level) and offices on the first floor.

A visual inspection was conducted by a certified COTO Bridge inspector in January 2023 utilising the Struman Bridge inspection methodology and all defects were rated according to their degree, extent and relevancy. The bridge comprises of a four span simply supported beam and slab deck. The deck consists of structural steel girders with a concrete slab cast above with corrugated decking as permanent shuttering.

## 2 Inspection Findings

The western span (span 1) of the bridge experienced fire damage to the underside of the deck. The fire, which was seemingly caused by vagrants living under the bridge, extended to the building above resulting in further structural damage.

The fire caused some of the lateral members and bracing elements to buckle as a result of thermal expansion. Furthermore, the heat produced likely changed the material properties of the structural steel elements, resulting in more brittle members, less flexible to movement.



**Fig. 1.** Underside of Span 1



**Fig. 2.** Buckled Lateral Member

The heat transfer through the structural steel beams and into the holding down bolts had resulted in thermal expansion in the bolts causing spalling to the reinforced concrete piers. In addition, the permanent shutter decking below the unreinforced concrete deck, had separated from the concrete creating voids and unsupported areas to the bottom fibers of the concrete deck.



**Fig. 3.** Spalling at Top of Pier



**Fig. 4.** Separation of Permanent Shutters

### **3 Remedial Works**

As part of the immediate actions, the client was advised to prop the underside of span 1 and close it off to the public until remedial works to the deck were complete.

A remedial works design was then conducted which comprised of removal and replacement of existing lateral members and diagonal bracing, installation of new longitudinal girders and installation of new lateral members to support the QC decking that had separated from the slab. The longitudinal members were placed below the permanent shutters, in-between the existing members and packer plates were used to ensure direct contact. Concrete repair was also conducted on all spalled concrete elements. The concrete was broken back, the reinforcement was primed with an epoxy zinc primer and a polymer modified fibre reinforced structural repair mortar was used to cover the reinforcement. Fencing was then installed around the abutments to prevent future access from vagrants.



**Fig. 5.** Installation of New Structural Steel Members