



# The Rakaia Gorge bridge deck replacement and seismic strengthening

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## Abstract

The Rakaia Gorge No. 1 Bridge on SH77 is a Category 1 Historic Place constructed circa 1882. The 55m span 'Bollman-like' truss is recognised as unique in the world and is also one of the oldest wrought iron bridges in New Zealand. To ensure that this important structure continued to provide a safe and resilient transport route, the deteriorating timber deck required replacement. Some innovative solutions were required to resolve the numerous challenges presented by this unusual structure related to load capacity, heritage effects, operational safety, seismic resilience, constructability and traffic management. The project sensitively balanced the conflicting objectives of state highway operations and heritage preservation – refurbishing the deck and providing seismic resilience to this strategically important structure, whilst respecting the heritage significance and successfully preserving the exceptional landmark appearance of the bridge.

**Keywords:** wrought iron; heritage; truss; deck replacement; NiuDeck; seismic strengthening.

## 1 Introduction

The Rakaia Gorge No. 1 Bridge is a State Highway bridge and a Category 1 Historic Place. This paper discusses some of the interesting challenges encountered when the deteriorating timber deck required replacement. These included the need to improve load capacity, minimise heritage effects, improve operational safety and seismic resilience, ensure constructability and mitigate traffic disruption during construction. The paper describes how these challenges were overcome through the solutions developed for this project. These include the use of a lighter weight deck system comprising steel transoms and laminated timber deck panels; reusing parts of the original transoms to preserve the historic appearance; detailed seismic analysis and strengthening; and several innovative details to aid constructability and mitigate traffic disruption.

## 2 Description of the Original Structure

The Rakaia Gorge No.1 Bridge, is a 55-metre span wrought iron truss bridge which carries State Highway 77 across the Rakaia Gorge. The bridge was constructed by the Public Works Department circa 1882 and is one of the oldest wrought iron bridges in New Zealand.

The wrought iron superstructure is unusual. The structural form has many similarities to both Bollman and Fink Trusses i.e. a girder supported at mid-span and quarter-span points by vertical posts which in turn are supported by a series of diagonal tie plates (Figure 1). In Bollman and Fink trusses, the diagonal ties would be anchored to the ends of the girders which in turn would act as the compression chord formed by truss action. Rakaia Gorge Bridge differs in that the diagonal ties are anchored directly into the rock outcrops at each end. The girders are supported completely independently of the ties, on cast iron pedestals,