

# Proceedings of the 10th Australian Small Bridges Conference 2021

JW Marriott Surfers Paradise, Queensland, Australia  
Monday 15<sup>th</sup> – Tuesday 16<sup>th</sup> February 2021

Platinum Sponsor



Gold Networking Drinks Sponsor



Silver Sponsors



**Humes**

BUILDING TRUST



Bronze Sponsors

mageba

InQuik  
BRIDGING SYSTEMS

LUSAS  
Infrastructure design software

Minor Sponsors

absafe  
GROUP

HYCHEM  
INFRASTRUCTURE SOLUTIONS

SPA  
SAVCOR PRODUCTS AUSTRALIA PTY LTD

SIMPSON  
Strong-Tie

Conference Produced by

LEADING  
INFRASTRUCTURE

10<sup>th</sup> Australian Small Bridges Conference 2021

Copyright © Leading Infrastructure Pty Ltd 2021

First published 2021

Published by Leading Infrastructure Pty Ltd

PO Box 616, Ashburton Victoria Australia, 3147

Email: [support@leadinginfrastructure.com](mailto:support@leadinginfrastructure.com)

URL: <http://www.leadinginfrastructure.com>

All rights reserved. Without limiting the rights under copyright reserved above, no part of this publication may be reproduced, stored in or introduced into a database and retrieval system or transmitted in any form or any means (electronic, mechanical, photocopying, recording or otherwise) without the prior written permission of both the owner of copyright and the above publishers. The authors of individual papers may freely distribute their work.

Printed by Leading Infrastructure Pty Ltd 2021

Proceedings 10<sup>th</sup> Australian Small Bridges Conference 2021

Leading Infrastructure Pty Ltd

ISBN 978-0-6451268-0-8

## Contents

Title	Author	Page No
Sunbury Culvert Modification Temporary Support and Staging <sup>3</sup>	Joe Abraham	4
Red Bridge Repainting, Structural Repairs and Introducing BIM for long term Asset Management	Antony Andradi	11
Haughton River Floodplain Upgrade Project	Aida Bartels	21
A Risk-Based Approach to Management of Remote Vehicle and Pedestrian Structures in Tasmania	Tim Chappell	46
The Latest Developments in Concrete Corrosion Protection for Infrastructure Assets	Atef Cheaitani,	71
Pi-girder - A full span precast viaduct for the Manila L1 Cavite Extension Project (L1CEP) in the Philippines	Ronan Chesnel	79
Design and Construction of Temporary Pedestrian Bridge at Martin Place Metro Station, Sydney	Natalie Cook	91
Pile Remediation and Scour Protection Subsea Solutions	Ray Crampton,	99
Structural Analysis of Buried Corrugated Metal Culverts	Satyajit Datar	102
New “Low Forces” Bridge Barrier Design. An example of FEA Simulation for Excellence in Design	Alexandre Dewaulle	112
Reviving an Iconic Structure – Repainting and Structural Repairs to the Logan River Red Bridge	Matt Duncanson	118
Collaborative Development of 300la Twin Cell Uniculverts for AURIZON Replacement Rail Culvert and Bridge Structures	Stephen Farrington	134
Embankment Retaining Walls Constructed in a Narrow Rail Corridor	Kim Guttridge	137
Longitudinal Braking/Traction and Thermal Force Assessment for Railway Bridges to AS5100:2017	David Han	181
Using Chloride Diffusion Modelling to Predict the Reduction in Global Warming Potential of Steel Reinforced Concrete Structures	David Harrison	193
Deep Scour Analysis and Flood Loading on Submerged Bridges	Elijah Holland	202
BR65 Veloway Bridge Over Lexington Road - Accelerated Design in the Time of Covid-19	David Lingard	213
A Serviceability Analysis of Pedestrian Induced Excitation on Light- Weight FRP Footbridges	Rohan McElroy	221
Muir Road and Bedwin Road Cable Bridges	David Molloy	241
Accelerated Program for Upper Lachlan Shire Council to Replace 3 Load Limited Timber Bridges	Logan Mullaney	278
Bushfire Recovery - Rebuilding Destroyed Small Span Timber Bridges Across Southern NSW	Logan Mullaney	281
Cock Lane Pedestrian Footbridge over Rail Peterborough, United Kingdom	Rupert Noronha	284

<b>Title</b>	<b>Author</b>	<b>Page No</b>
Stamford Rail Integral Underbridge Peterborough, United Kingdom	Rupert Noronha	303
Vines Creek Bridges Mackay, Queensland	Rupert Noronha	322
Competing Design Pressures Between Site-Specific Solutions and Uniform Project-Wide Solutions for Structural Pedestrian Overpass Designs at Railway Stations	Rob Pallot	344
Design and Construction of Toorak Road Multi-Span Rail Bridge	Daniel Pang	355
Tharwa Bridge Maintenance – Lessons Learnt	Marcia Prelog	367
Rooty Hill Station Easy Access Upgrade: Pedestrian Bridge Design and Construction with Multiple Site Constraints	Nebojsa Ravic	374
Outcomes of a Collaborative Approach – Newcastle Inner City Bypass Early Works Shared Path Bridge	Nathan Roberts	391
Gap Between the Precast Culvert Cells and Their Effect on the Design of Culvert Base Slab	Dr Stephen Salim	409
Integral Bridge Design of Moggs Creek Bridge Replacement	Dr Stephen Salim	414
Prioritisation Strategy for Timber Bridge Replacements	Susie Seeto	425
Restoring Corroded and Deficient Piers – Durability and Structural Strengthening Solution of Dunbogan Bridge Piers	Tim Shaw	433
Steel Truss Load Assessment for Aging Bridges Using FEA and AS5100:2017	Daniel Stephenson	455
Retaining Wall Systems Interfacing with Bridge Abutments	Ian Ward	468
State-of-Practice in Large Diameter Driven Tubular Piles on Woolgoolga to Ballina Pacific Highway Upgrade Project	Henry Zhang	482

# Sunbury Culvert Modification Temporary Support and Staging

Joe Abraham, Temporary Works Coordinator, CPB Contractors

Jawad Zeerak, Associate Principal Geotechnics, EIC Activities

Max Un, Principal Structural Engineer, AECOM

Megan Ward, Graduate Engineer Geotechnics, EIC Activities

## ABSTRACT

To take full advantage of the extra capacity on the rail network created by the Metro Tunnel, a range of enhancements are needed on the Sunbury Line to allow larger, more modern trains to run. The Sunbury Line Upgrade (SLU) will see various upgrades within the rail corridor extending from Footscray to Sunbury. As part of this project, Rail Infrastructure Alliance (RIA) is upgrading power, train stabling, station platforms and other associated infrastructure along the Sunbury Line. To accommodate the installation of additional rail track near Sunbury station, an extension to an existing bluestone culvert at Sunbury, constructed in 1859, was proposed. This culvert structure features steel deck, and substructure of bluestone masonry abutments, wing walls and invert slab. Part of the existing invert slab which provides propping support, was required to be demolished for the construction of the extension. Due to an operational rail environment, this scope had to be delivered during limited rail occupations. A temporary works design and staging solution was developed to ensure safe demolition of the culvert invert slab and construction of the permanent structure during live train operation, while maintaining the stability and limiting movement of the existing bluestone wingwall. The solution consisted of temporary propping and a comprehensive staging plan. This paper discusses the various options considered, design development, challenges, methodology and monitoring of culvert and tracks during construction including performance of the temporary propping from a design and construction perspective.

## 1 INTRODUCTION

The Sunbury Line Upgrade (SLU) is being delivered in part by the Rail Infrastructure Alliance (RIA) to provide rail infrastructure upgrades to support the Metro Tunnel Project and deliver major improvements in capacity, reliability, and frequency of services on the Sunbury Line. RIA is an alliance between Rail Projects Victoria (RPV), CPB Contractors, John Holland, Metro Trains Melbourne (MTM) and AECOM. A combination of power upgrades and platform modifications is needed to enable future High Capacity Metro Trains (HCMTs) to operate along the existing Sunbury Line. CIMIC's engineering and technical services business EIC Activities (EIC) provides design and technical support to the project.

SLU will see various upgrades within the rail corridor extending from Footscray to Sunbury. To enable the addition of a new track at Sunbury, widening of the existing heritage listed, masonry bluestone culvert (Sunbury culvert) was required. This paper discusses the design, staging and construction of the temporary works to enable the bridge modification works. The temporary support scheme and staging plan, in addition to ensuring stability and integrity of the structure, also allowed the Sunbury train line to remain operational throughout the construction period.

### 1.1 Existing Sunbury culvert

The Sunbury culvert was constructed in 1859 on the Sunbury train line with bluestone masonry. It is of regional significance as one of the original structures on the Melbourne to Bendigo railway (Figure 1 below). Over time, the Sunbury culvert has undergone some modifications to adapt to the changing rail environment. The most recent modification was undertaken in 2003 as part of the regional fast rail project which replaced the deck to steel troughs supported on steel beams.

The initial site investigations undertaken by RIA, ascertained the existing invert slab provided support to the wingwalls. Initial stability checks further confirmed that removal of invert slab or parts of it would have an inverse effect on the stability of the existing structure. In addition, the masonry structure was considered to be sensitive to excessive movements which could result in development of tensile

forces within the structure in particular at the joints. Therefore, a temporary support scheme was required to ensure stability of the wing walls and existing structure during construction and limit any movements on the structure.

## 1.2 Proposed Deck Widening

RIA is undertaking widening of the existing Sunbury masonry culvert as part of the SLU scope of works. The widening works involve a new concrete structure on new pile foundations. This requires partial demolition of the existing invert slab of the culvert to facilitate the construction of the new substructure. The demolition works comprises partial removal of the existing bluestone invert slab for an area of 2.5m x 4.75m to 400mm below the existing invert at the lowest point below the curved slab. An extract from design of the proposed modification and widening works is shown in Figure 2 below.



Figure 1 – Historical drawings of Sunbury culvert (L), Existing culvert before widening works (R)

## 2 GEOTECHNICAL CONDITIONS

Despite a relatively consistent geology area across the larger site, the local geology and subsurface ground conditions at the location of the culvert structure was relatively complex and variable. As can be seen in an extract from Geological Survey of Victoria (GSV) Sunbury Map sheet, Quaternary aged Newer Volcanics basalt (Qvn) covers most of the site to great extents, with colluvium deposits (Qrt) locally found within the Sunbury culvert area as shown in Figure 2.

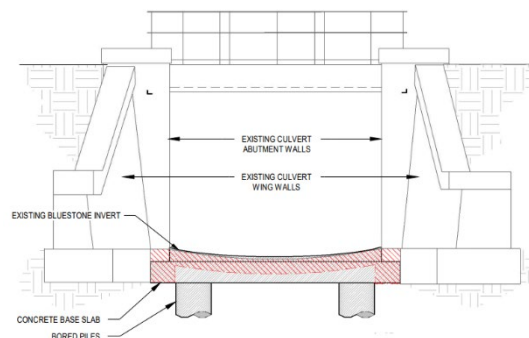


Figure 2 – Sunbury Mapsheet, GSV (L), Proposed modification of culvert (R)

Additional boreholes and piling works for the structure foundation, revealed high strength conglomerates at restively shallow depths below the existing surface.

A design subsurface ground profile and associated geotechnical parameters were assessed based on the available site investigation data and used in the geotechnical analysis which are generally in line with the parameters used in the design of the bridge widening works.