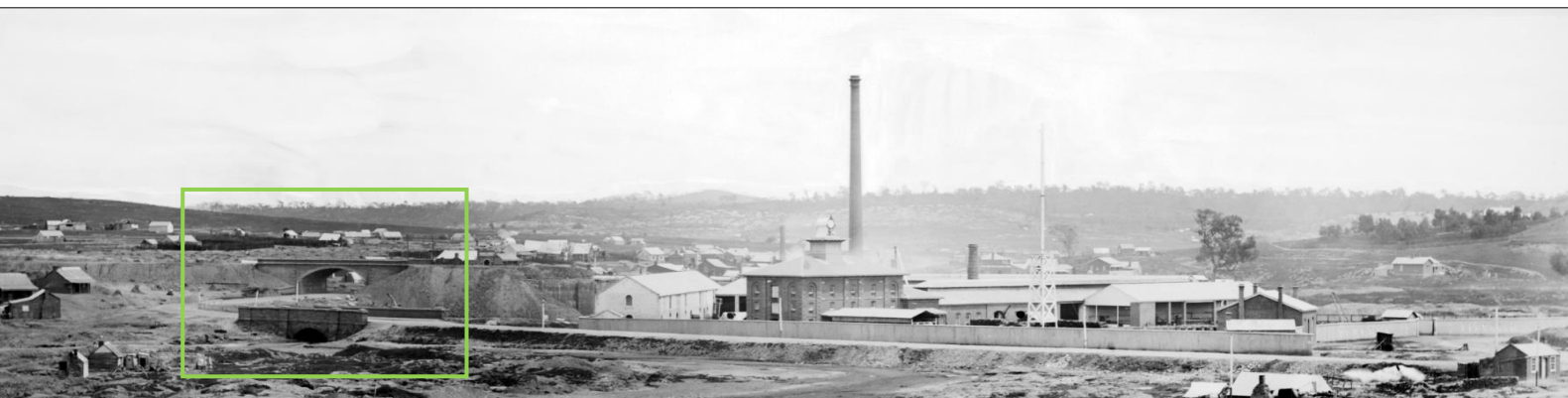


Victoria Railways Midlands Hwy Bridge Extension Design 1895 (Courtesy Vic Track)

Heritage Impact Statement

Midland Hwy Rail Bridge Castlemaine
 Project: SDMBGO-BR-124714 - Superstructure Remediation
 Project Code: MPM24P-04-17
 VHR H1664 - Castlemaine Railway Precinct
 HV Application Number: P40204
 Submission Date: 18th November 2024



Castlemaine c.1865 Midland Hwy Bridge to left of photograph.
<https://www.victorianrailways.net/photogallery/northmid/castlemaine/castlemaine.html> (State Library of Victoria)

Report Data

This Heritage Impact Statement forms part of a permit application for: Waterproofing and concrete lining reinforcement of red brick masonry arch Midland Hwy Rail Bridge, (1862) (also known as the Johnston St and Pyrenees Hwy bridge) Castlemaine Railway Heritage Precinct VHR H1664, Victoria.

Legislative Requirements: A permit application is required for these works under the Heritage Act 2017 (Vic).

Pre-Application Meeting: 3rd October 2024 with Katrina Dernelley, Heritage Officer (Permits) Planning and Land Services Heritage Victoria

Asset Owner: Leigh Bromley Acting Director, Regional Rail and Southern Cross Station DTP, GPO Box 2392 Melbourne Vic 3001

Policy and guidance. This report has been prepared with regards to relevant principles and policy documents, including:

- The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance, ICOMOS, 2013
- Guidelines for Preparing Heritage Impact Statements, Heritage Victoria, June 2021
- Principles for considering change to places in the Victorian Heritage Register, Heritage Victoria, December 2022
- Reasonable or Economic Use Policy Procedural, Heritage Victoria, June 2021

Report prepared by: Greg Deftereos Heritage Advisor/Archaeologist V/Line L7 452 Flinders St Melbourne Vic 3000
 ABN 91 273 289 190 <https://www.linkedin.com/in/gregdeftereos/>



Midland Hwy Bridge, Castlemaine 2024 (Google Maps).



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Executive Summary

This Heritage Impact Statement outlines the potential heritage impacts of proposed arch support works at Midland Hwy Bridge (1862) (also known as the Johnston St and Pyrenees Hwy bridge) part of the Castlemaine Railway Precinct VHR H1664 and Mount Alexander Shire HO670.

Today's Midland Hwy Bridge is actually two bridges combined, consisting of the original red brick masonry arch bridge with basalt abutments (1862) with the later addition of an unreinforced concrete arch with granite abutments (1895) built to carry a third track to Maryborough Goldfields. The red brick masonry arch carries two fast rail V/line tracks while the third track bridge section is currently operated by the Victorian Goldfields Railway (VGR).

The proposed works will provide waterproofing membrane extrados of the arch and concrete lining reinforce the red brick masonry intrados of the arch of the Midland Hwy Bridge, protecting and extending to considerable degree (c. 50 years) the structure's longevity and integrity. It will be at the cost of minor impact to heritage fabric of the structure's masonry. Visually the impact will be evident but again minor, and the concrete lining will be tinted a colour matching the rest of the bridge.

In sum, there will be minor impact to the structure's fabric or heritage significance in exchange for overall structure's integrity and longevity that will not overly detract from the item's heritage values/significance



Fig.1. Facing east is original bridge with stone face arch voussoir and bluestone abutments (1862).



Fig.2 Facing west (1895 bridge extension) is the concrete lining 'voussoir' and barrel vault bridge addition with rectangular brick piers, wingwalls, and granite abutments.

1.0 Statutory Registers

The item is entered on the Victorian Heritage Database under VHR H1 664 'Castlemaine Railway Precinct' under the provisions of the Heritage Act 2017 (Vic). The item is also entered on the Heritage Overlay (HO670) of the Mount Alexander Shire Planning Scheme under the provisions of the Planning and Environment Act 1998 (Vic).

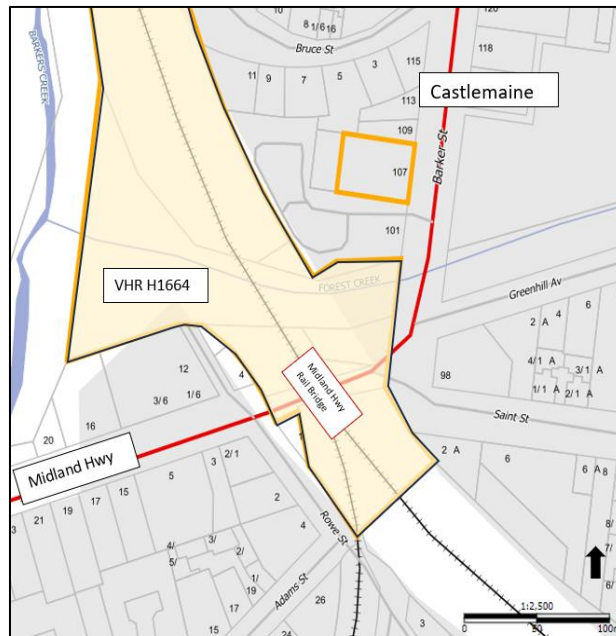


Fig. 3a. Bridge location, VHR H1664. (Vicplan)



Fig. 3b. VHR H1664 Castlemaine Railway Precinct (Vicplan). Midland Hwy Bridge – red rectangle.

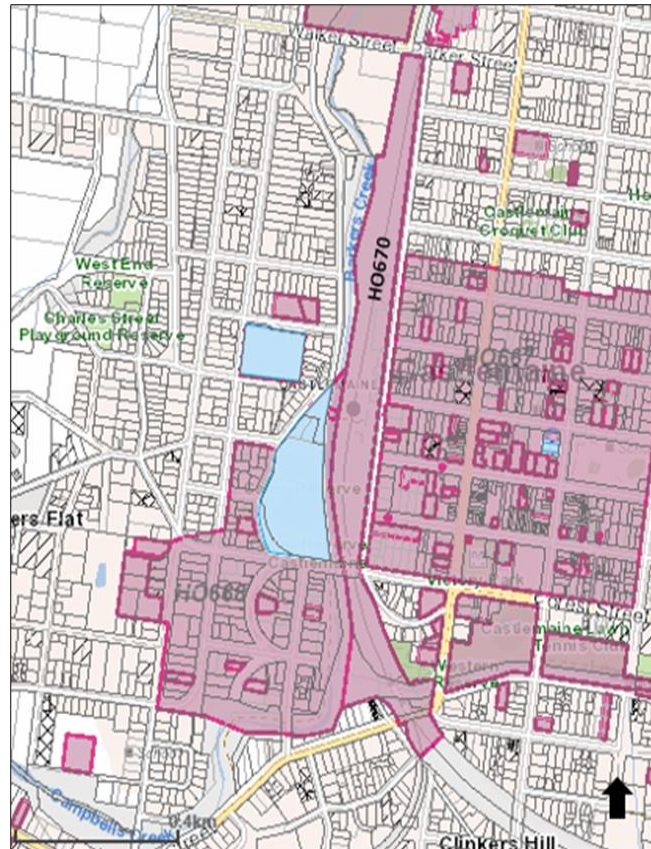


Fig. 3c. HO670 Mount Alexander Shire (Vicplan)

2.0 The Midland Highway Bridge

The rail bridge and embankment was built in 1862 for the Victorian Railways during the establishment of the rail network¹ as part of the initial 'Great Trunk Lines' period of rail construction². It is a red brick and basalt structure and consists of a single, depressed arch, with curved battered abutment walls. The masonry features a double buttress, voussoirs, single stepped string course, the bi-chrome brick and rusticated basalt quoining (mildly echoing the Station building), parapet and wingwalls. It was based on the aesthetics of classical planning principles, directly derived from popular English designs of the 1840s-1850s in the UK, employing contemporary stone masonry and building techniques of the time. Similar in style to the Chewton rail over bridge (1864) (VHR H1780) of the Taradale district characteristic of the Chewton and Castlemaine section of the line the original bridge has basalt abutments whereas the 1895 bridge extension has granite abutments, granite being characteristic of the Chewton and Castlemaine style.

The Midland Hwy Rail Bridge is a single span 11.9m long span, skewed (20 degrees) masonry arch built in 1862, as a component of Castlemaine Railway precinct. The bridge has a posted vertical clearance of 4.1 m. An unreinforced concrete arch with granite abutments was added in 1895 to the original 1862 red brick masonry arch bridge to widen the rail bridge in order to carry a third track to Maryborough Goldfields widening the entire structure to c. 13m.

The Midland Hwy Rail Bridge is complimented by the high three span, highly skewed railway bridge over Forest Creek, c.1862, which retains its solid original brick and stone-dressed piers and abutments and original riveted wrought iron beams. Its spans have been strengthened (likely to accommodate heavier rolling stock in the early twentieth century) by the placement of intermediary piers of RSJs and angle-iron

¹ The Victorian Railways: A Thematic History. GIM Heritage. 2024 p.4

² Ward, A. A Story of Stations 2021 p121.

on concrete foundations. The Forest Street bridge is also slightly skewed and retains the bi-chrome brickwork with stone dressings characteristic of the Castlemaine Railway Precinct. There is a similar bridge c. 5km to the north of Midland Hwy Bridge on Sawmill Rd (HO684) (Fig.5.) not included on the VHR. All of these historical bridges, together with the railway embankment, are important contributory structures within the Castlemaine Railway precinct.

3.0 Significance of the place or object

3.1 The Castlemaine Railway Station Precinct

Castlemaine Railway Station and precinct remains one of Victoria's more elaborate and intact railway station precincts persisting with relatively moderate modification. Ward and Donnelly (1982)³ characterize Castlemaine Railway Station (1862) as the signature piece of its own style in the lexicon of Victorian Railway Stations, falling into the Italianate/Mid Victorian category.

3.2 Castlemaine

In 1851, gold was discovered at Forest Creek Castlemaine. The area became known as the Mount Alexander Diggings. The Government set up its camp in the area which would eventually evolve into the city of Castlemaine. Reflecting the wealth of the goldfields, the township was laid out with wide streets, botanic gardens and grand buildings, much of which stands today. Castlemaine railway station opened in 1862 and was the major junction station on the Bendigo line known then as the 'Main Line', reflecting its status as the most important country line in Victoria. During this period, Castlemaine was a large centre, and such was the economic and political clout of the locality that the planned Bendigo railway was diverted through rough country, necessitating construction of the Elphinstone tunnel, to reach the municipality rather than following an initial proposal of a branch-line from a mainline located further east.

At the height of its use in the late 19thc Castlemaine station had three passenger platforms, an interlocked yard with two signal boxes, and extensive goods facilities together with a locomotive sub-depot located at the northern end of the yard. Despite all of this, there were further substantial extensions early in the 20th century. During the heyday of the Maldon Railway, the austere branch-line facilities were a stark contrast compared to the characteristically lavish style of the Castlemaine buildings and facilities. The Castlemaine 'A' signal-box remains a prominent feature on the island platform. It is one of the few remaining mechanical signal-boxes in Victoria and the larger of the two signal-boxes that existed at Castlemaine. Both boxes were decommissioned in 1989) and replaced by a signal control panel in the station building. Whilst the 'B' box was demolished, the 'A' box is now operational under the custodianship of Victorian Gold rush Railway.

³ Ward, A and A. Donnelly. 1982. Victoria's Railway Stations. An Architectural Survey Vol 2. ARHS Melbourne p.157



Fig 4. Castlemaine Railway Station Looking north (c.1870). To the right is Signal Box 'B' now demolished. Midland Hwy Bridge is to the south and not in picture. <http://handle.slv.vic.gov.au/10381/145873>



Fig.5. Section of photograph looking South-West from Castlemaine town c1865, and construction of the 'Main Line' is well under way. Cornish & Bruce, the principal contractors for the building of the line, have set up in the former three storey Flour mill on Barker Street. The foundry they established on this site supplied the ironwork needed for much of the infrastructure along the route. The brick and basalt skew arch bridge [Midland Hwy Bridge] spanning Johnstone Street [Midland Hwy], (centre), has been erected and the filling in of the extensive bank, toward the station has been completed as far as the partially completed brick and granite viaduct over Forest Creek [future Forest Creek Bridge].

<https://www.victorianrailways.net/photogallery/northmid/castlemaine/castlemaine.html>

3.3 The Cultural Heritage Significance of the Place or Object.

The following is derived from the Victorian Heritage Database⁴

What is significant?

The Castlemaine railway precinct forms part of the Murray Valley Railway (Melbourne to Echuca line). Opened in five stages from February 1859 to September 1864, the Murray Valley Railway was the largest of the Colony's first two trunk lines. Thematically, the precinct is important as representing the establishment of the Victorian Rail network, as one of the two trunk lines of the initial build outside of the greater Melbourne area⁵. The inability of the line's original private promoters - the Melbourne, Mount Alexander and Murray River Company - to raise sufficient funds to construct the line, led to the government purchasing the company and embracing a public railway system. The Government's decision to construct the line in 1856 was accompanied by the formation of the Victorian Railways Department. The building of the line during the early 1860s reflected the strategic economic issues of the day: servicing the important goldfields of Castlemaine and Bendigo and capturing the Murray River and Riverina trade for the Port of Melbourne. With a labour force of more than 6,000 men, the Melbourne to Echuca line was the Colony's largest capital works project of its time. The line is still used today for public transport and freight services and comprises a very large number of structures and facilities of varying ages, conditions and degrees of operational and business significance.

How is it significant?

The Castlemaine railway precinct is of historical and scientific importance to the State of Victoria.

Why is it significant?

The Castlemaine railway precinct (comprising the Midland Highway Rail-over bridge, Forest Creek viaduct, Forest Street rail-overbridge, Castlemaine Railway Station, and embankment) is historically and scientifically significant as an integral part of the railway line and is an important representative sample of one of the earliest and grandest capital works projects in Victorian history. The identified features comprising the precinct are all substantially intact and provide a crucial reminder of the adoption of English engineering and architectural standards and the role of the Victorian Railway Department in developing the Colony's engineering expertise.

The Castlemaine Station is of architectural significance as an important and intact example of a station complex on the line. The Castlemaine Station is the largest and most important example of the 'Castlemaine' style of building. The 'Castlemaine' style employs many Italianate features such as heavy rusticated quoining, eaves corbelling and low hipped roofs. The use of timber to the verandas is a unique feature. The two rail-overbridges, viaduct, and associated embankment are excellent examples of the range of materials, building techniques and design types used on the Kyneton to Bendigo section of the line. The precinct makes an important contribution in defining the character of the Victorian railway network the opening of the railway, which made considerable difference to the local farming industry and the prospect of successful farming, as well as improving the link with New South Wales and Seymour generally. The scale of the station, especially the large refreshments room, kitchen and dining rooms [sadly no longer] and the turntable recall the station's former prominence as a rail terminal.

⁴ Victorian Heritage Database <https://vhd.heritagecouncil.vic.gov.au/places/259>

⁵ The Victorian Railways, A Thematic History. GJM Heritage, Melbourne 2024 p4.

3.4 How is Heritage Significance represented by the Midland Hwy Rail Bridge?

What is significant?

The Midland Hwy rail bridge and embankment is historically and architecturally significant to the State of Victoria within its context of the Castlemaine Railway Precinct.

How is it significant?

The Midland Hwy rail bridge and embankment is historically and architecturally significant to the State of Victoria within its context of the Castlemaine Railway Precinct. Sawmill Rd Bridge Castlemaine (HO684) is an almost identical design c. 5km to the north of Midland Hwy Bridge that conversely carries road traffic over the rail line. Sawmill Rd Bridge Castlemaine (HO684) is a similar design c. 5km to the north of Midland Hwy Bridge that conversely carries road traffic over the rail line and its stylistic/architectural associations with the bridges of Chewton Railway Station precinct.

Why is it significant?

The rail bridge is historically and scientifically significant as an integral part of the railway line and is an important representative component of what is regarded as one of the 'earliest and grandest capital works' projects in Victorian history and its association/characterization of the Castlemaine 'style'.



Fig.6. Sawmill Rd Bridge Castlemaine HO684 is characteristic of the Chewton and Castlemaine style.

3.5 VHR Significance Criteria

The following references VHD citation on relevant significance criteria⁶.

Table 1. VHR Significance Criteria

VHR Criteria	Response
Criterion A: Importance to the course, or pattern of Victoria's Cultural History.	<p>Thematically Midland Hwy Rail Bridge is significant as an architectural component within its context of the Castlemaine Railway Precinct.</p> <p>Castlemaine Railway Station is representative of Victoria's own 'Railway revolution'⁷ that accompanied the Victorian Gold Rush and subsequent economic development of the State in the mid to late 19thc. It was built in the period of the 'main trunk lines' c.1857 - c.1869, also referred to as 'our great national lines of railway'⁸, the formative years of railway development in Victoria. The economic development that ensued from the general wealth created allowed regional communities to establish viable and sustainable economic bases, in turn promoted and enabled by the rail.</p>
Criterion D: Importance in demonstrating the principal characteristics of a class of cultural places and objects.	<p>The Midland Hwy rail bridge and embankment is historically and architecturally significant to the State of Victoria within its context of the Castlemaine Railway Precinct. Sawmill Rd Bridge Castlemaine (HO684) is a similar design c. 5km to the north of Midland Hwy Bridge that conversely carries road traffic over the rail line and its stylistic/architectural associations with the bridges of Chewton Railway Station precinct. Similar to the Chewton rail over bridge (1864) (VHR H1780) the ornateness and materials evidence the move away from the granite of the Taradale district to the characteristic bichrome brick and granite of the Chewton and Castlemaine section of the line.</p> <p>The bridge as it falls under Castlemaine Railway Station precinct is an intact representative example of a mid 19thc 'Boom period' Victorian Railway precinct. It is becoming relatively rare to locate structures of this scale and relatively intact condition, that were once so important to local and regional communities, exemplifying past lifeways, before the invention of the automobile and its following large-scale adoption, and the modal changes that entailed.</p>
Criterion E: Importance in exhibiting particular aesthetic characteristics.	<p>The rail bridge is historically and scientifically significant as an integral part of the railway line and is an important representative component of what is regarded as one of the 'earliest and grandest capital works' projects in Victorian history and its association with the Chewton Castlemaine 'style'.</p>

⁶ The Victorian Heritage Register Criteria and Threshold Guidelines https://heritagecouncil.vic.gov.au/wp-content/uploads/2019/05/VHRCriteriaandThresholdsGuidelines_2019Final.pdf

⁷ Alderman, G. 1971. Review: The Victorian Transport Revolution, in The Historical Journal Vol.14, No.3 Sept. 1971 pp.635-644. Cambridge University Press

⁸ Ward A. 2019. A Story of Stations. The Architecture of Victorias Railways in the 19thc. ARHS. pp121.

	<p>Castlemaine Railway Station and precinct remains architecturally significant as a rare and relatively intact example of its own signature style (Ward 1982). The Midland Hwy Bridge is a significant and intact and working component of that precinct, particularly as it is characteristic of the architectural style and engineering solutions of the period of construction.</p>
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4.0 Existing condition of the place or object



Fig. 7. Midland Hwy Bridge Soffit (2024)

The bridge remains largely intact, water damage and cracking is noticeable in the soffit and there is the risk that this erosive process is loosening bricks and materials.

In 2017, a waterproof membrane was installed over the arch to mitigate water ingress and seepage in the arch. However, by 2020, water seepage on the arch was evident indicating that the liner may have only been effective for up to two years.

Two site inspections were undertaken by V/line Network Engineering representatives on 14/04/2023 and 20/09/2023 to assess the arch's structural condition and investigate the drainage issues. The inspections identified the following defects:

- Loose and dislodged bricks and mortar
- Differential movement of arches
- Longitudinal cracks along the brick barrel
- Brick and mortar erosion
- Failure of the waterproof membrane
- Cracking and displacement at the spandrel wall.
-

(Refer Midland Highway Bridge Structural Report SDMGBO-BR-124714 SMEC 9/9/2024)



Fig.8. Longitudinal cracks along the arch soffit.⁹



Fig.9. Deterioration of the bridge soffit at interface between concrete lining of the 1895 bridge and the red brick barrel vault of the original 1862 bridge.¹⁰

The bridge carries the following rail loading three rail tracks:

- Two V/Line broad gauge (2.600 m wide sleepers) tracks on the East of the bridge (over the masonry arch)

⁹ Midland Highway Bridge Engineering Investigation Report TC-ENG-23008 V/Line 24/10/2023 p.7.

¹⁰ Midland Highway Bridge Engineering Investigation Report TC-ENG-23008 V/Line 24/10/2023 p.9.

- One Victorian Goldfields Rail track on the West side of the bridge (over the unreinforced concrete arch).

According to the V/Line Network Service Plan (NSP) dated 3/07/23, G-Class locomotives are restricted to a speed of 30 km/hr of the bridge. Additional signage at track level also restricts R-Class locomotives to 30 km/hr.

5.0 The Proposed Works

5.1 Waterproof Membrane & Spandrel Wall & Parapet Rectification

To improve drainage from the track level of the arch, a new waterproof membrane will be installed to mitigate further arch deterioration. Layers of asphalt and chemical waterproofing will be introduced as an additional layer or replacement to improve on the current waterproofing performance of the system. Introduction of a waterproof membrane will mitigate further deterioration of grout and masonry units in the arch. There are no identified heritage/material impacts with regards to the Waterproofing works. The proposed waterproofing system includes the following:

- 1- Surface water drainage system
 - a. Clay capping layer
- 2- Lower waterproofing
 - a. Waterproofing membrane
 - i. Single sheet, seam welded durable plastic sheeting
 - b. Sprayed waterproofing membrane
 - i. Historically, the extrados of arch bridges were coated with a tar or bituminous layer to keep water from penetrating through the arch barrel and washout out the mortar.
 - ii. Modern technology allows for more flexible materials; and we have proposed the use of an elastomeric liquid membrane (Tamseal 800L) that has good robustness and elongation properties to suit the dynamic nature of the rail environment and work across joints.

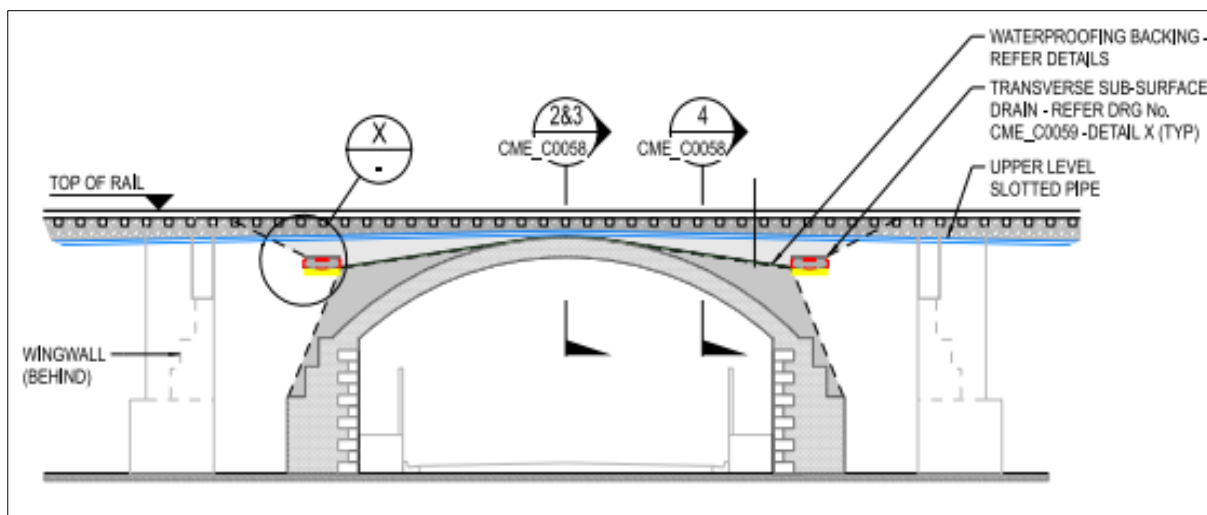


Fig.10. Design Excerpt SMEC Engineering

The process will involve,

- Removal of existing fill and cleaning of extrados of existing arch covering by brooming and air blowing. Removal of existing bitumen.

- Apply epoxy mortar layers to remove depressions and seal over cracks

Refer *Midland Highway Bridge Structural Report SDMGBO-BR-124714 SMEC 9/9/2024*

A longitudinal crack was observed between the existing spandrel wall and parapet for the masonry bridge arch barrel. The soffit of the spandrel wall at the crown appears lower than the arch barrel with broken brick visible. Water was leaking through this joint at the crown of the arch. Rectification of the spandrel wall was discussed. If construction works were to proceed with the staged approach, there was a concern that the concrete lining may impact any future rectification works to the spandrel. SMEC Engineering Consultants believe the concrete lining won't impact the spandrel wall rectification unless the works proposed to close back the spandrel which is unlikely to be proposed or recommended. SMEC presented a more likely solution which has been adopted on other bridge spandrels involving a 'tie based system'. This tie-based system involves a tie rod/tension member connecting the two spandrel walls and would be at the bridge deck level thus not impacting the proposed structural concrete lining. However, SMEC recommended that if spandrel works were to occur, they should occur at the same time as the waterproofing works.

5.2 Concrete Lining Intrados of Masonry Arch Bridge section

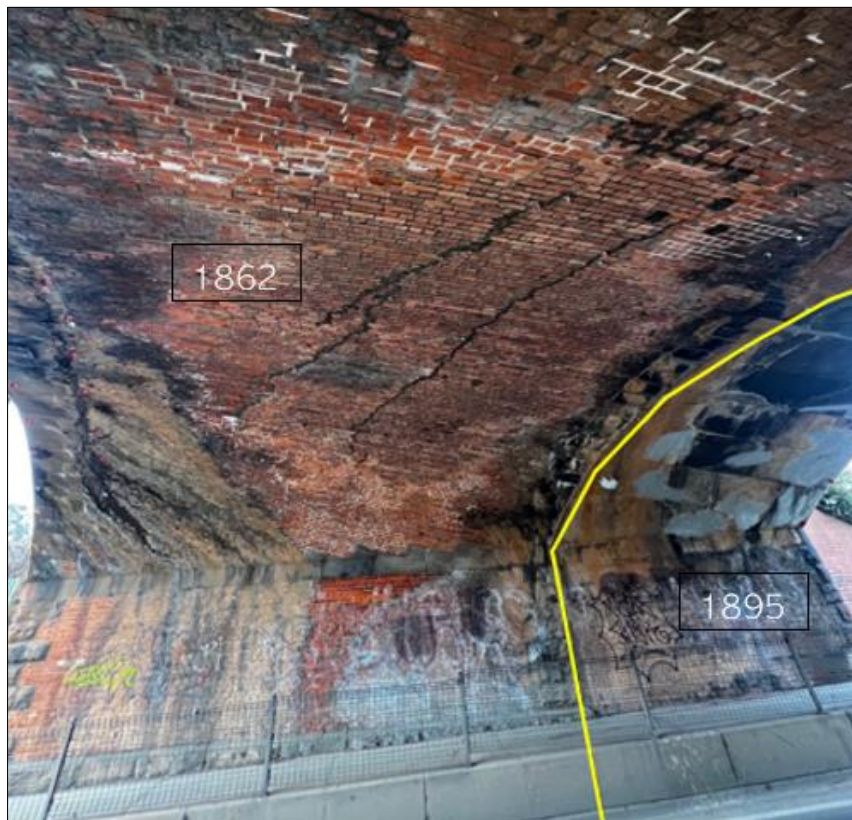


Fig.11. The 'two bridges', red brick barrel to the left (1862) and concrete lining barrel addition (1895) to the right. The concrete lining works are proposed to extend to the whole of the bridge barrel vault.

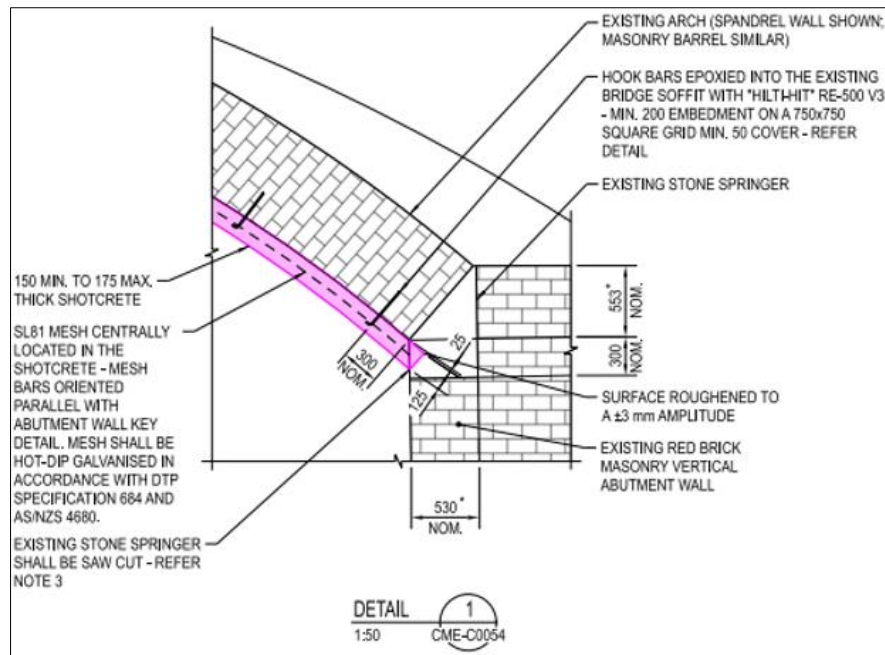


Fig.12. Design Excerpt - SMEC

Concrete lining the soffit of the arch would provide a secondary concrete arch to support the integrity of the existing masonry arch with the primary purpose of ensuring that any defective bricks do not drop or spall down to road users and pedestrians below. Concrete lining of the intrados has already been completed on a number of V/Line masonry arches that pass over roads (see Fig.14.). The concrete lining in combination with the waterproofing membrane would extend the effective life of the structure. Steel reinforcement would be doweled into the masonry arch to engage it in a composite action with the concrete arch. Lining to the intrados of the arch will also eliminate the risk of dropping bricks and mortar loss.

The proposed design includes N12mm diameter steel dowel hook bars (350mm long with 75mm cog) epoxied into the existing brick soffit with a minimum embedment of 200mm on a 750mmx750mm grid will be inserted into the soffit of the existing arch to provide hooks for the shotcrete mesh to be tied to. The arch lining will also be keyed/cut into the existing stone fabric abutment. The alternative is to continue the concrete lining to abutment base (as was done at Fryers Rd Bridge Chewton Fig.14) however this would then make the pedestrian underpass DDA non-compliant *DDA 1992* (Cth) and would require more dowel hooks.

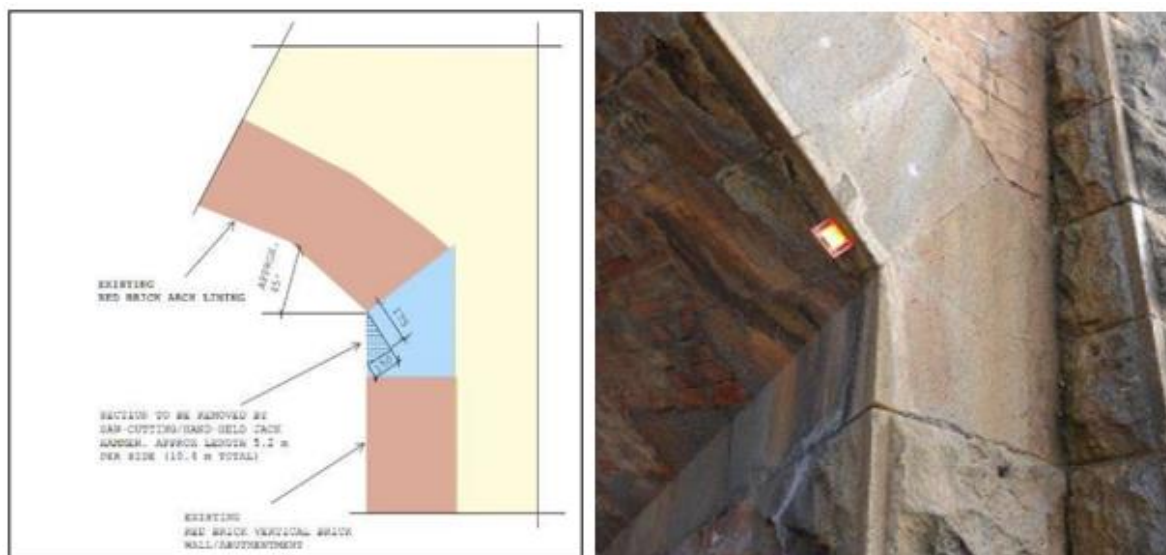


Fig.13. Concrete lining to be keyed into basalt abutment

This proposal

- Achieves project objective of eliminating risk of brick dislodging and mortar loss
- Reduces overall extent of construction works
- Minimally impacts the existing footpath
- Minimises visual impact of proposed lining, by retaining the existing abutment fill

Table 2. Heritage Impacts

Potential Material Impacts	Mitigations
Dowel rod penetrations	Impacts to bridge soffit fabric bricks. Penetrations will be minimal
Concrete Lining cutting into abutment	Impact to bridge fabric. Cutting will be small impact into stone springer. Cutting will limit concrete lining to bridge barrel vault/soffit. Photographs record the existing condition.
Views	Impact to visual aesthetic may be noticeable but will be receded with colour tinting of concrete to match overall bridge hues.

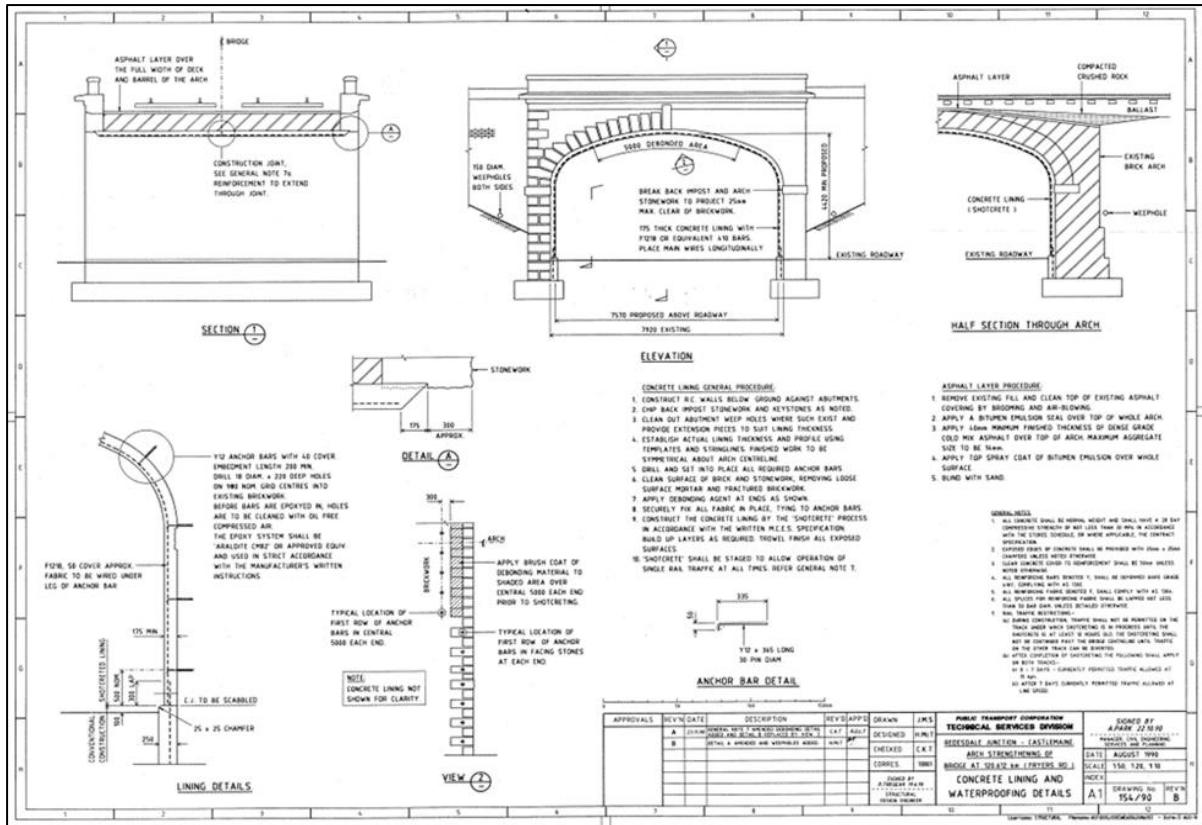


Fig.14. Fryers Rd Rail Bridge Chewton - SDMBGO-BR-120612. Concrete Lining Design 1990 (VicTrack)



Fig.15. Fryers Rd Rail Bridge Chewton, (VHR H1780) with bridge soffit concrete lining installed in 1990. Note that this lining has not been colour tinted to match the overall structure.

A similar solution was carried out at Fryers Rd Rail Bridge Chewton (VHR H1780), note however, that the Chewton Bridge has lining continuing to abutment base, whereas the solution proposed at Midlands Hwy

is for the lining to be tied into the base of the arch and not continue vertically down the arch sides. The lining for Fryers Rd bridge was/is 175mm.

Table 3. Concrete Lining option

Pros	Cons
Strengthen the structure to min 230LA	Slight reduction in vertical height of bridge – less than 200mm
Extend structure life for minimum 50 years	Heritage impact of lining the arch barrel
Eliminate risk of falling structure elements – bricks and mortar loss	Requires full road closure of Midland Highway and rail occupation for period of works.
Earthworks limited to installation of waterproof membrane	Minimal yet notable impact to bridge materiality
Portal faces of structure retained for heritage significance	Visible but receded
Aesthetically, the proposed lining will match the 1895 bridge extension, which has a concrete lining soffit.	
Visible but receded	

6.0 Options Considered

Among the options considered below remain the most viable. Refer *Midland Highway Bridge Engineering Investigation Report TC-ENG-23008 V/Line 24/10/2023*.

6.1 The MARSYS-Helifix System

The MARSYS-Helifix option is viable as similarly minimally impactful to the heritage structure, as minimal fabric is removed, and also because this solution has proven an effective strengthening/remediation strategy at Seymour Railway Station southern pedestrian underpass, managed by ARTC. As the strengthening is grooved and installed with the existing masonry arch, there is no reduction to head clearance and limited change to the structure appearance. The MARSYS system will also increase the capacity of the masonry arch thus increasing its remaining service life. A waterproof membrane at track level is also recommended to be installed in tandem with the MARSYS strengthening to mitigate water infiltration through the arch and reduce deterioration of the masonry bricks and mortar. All other options explored, maintain the existing structure, however, would involve extensive design and construction effort to undertake the proposed options. The MARSYS – Helifix System is a reinforcement system that utilises stainless steel bars set out in a grid formation to provide a continuous tensile layer along the intrados of the barrel (Parrot & Lahra 2014). The system allows for improved capacity of the arch by providing improving the tensile capacity of the intrados, bonds the multiple arch rings together allowing the structure to act as a single arch barrel, and increase the arch's theoretical ductility to resist greater deformation. The formation of cracks, separation of existing cracks and failure hinges within the arch are greatly reduced. A potential structural capacity 230LA or greater and an extended life of 50 year may be achieved.

The system allows for improved capacity of the arch by providing improving the tensile capacity of the intrados, bonds the multiple arch rings together allowing the structure to act as a single arch barrel, and increase the arch's theoretical ductility to resist greater deformation. The formation of cracks, separation of existing cracks and failure hinges within the arch are greatly reduced. A potential structural capacity 230LA or greater and an extended life of 50 year may be achieved.

The cost of the MARSYS-Helifix System is believed to be one and a half to twice as expensive as the concrete lining proposal. The bridge would still require waterproofing works.

Table 4. MARSYS-Helifix option

Pros	Cons
Strengthen the structure to min 230LA	
Extend structure life for minimum 50 years	Heritage impact of lining the arch barrel
No reduction of vertical height	
Earthworks limited to installation of waterproof membrane	May not eliminate risk of falling structure elements – bricks or mortar loss
Portal faces of structure retained for heritage significance	May require specialist contractor to conduct design and construction
	Requires full road closure of Midland Highway and rail occupation for period of works.
	Minimal yet notable impact to bridge materiality
	Cost – estimated to cost up to double of concrete lining.
	Will require temp works to support the arch during installation

6.2 New Independent bridge structure over existing arch.

A new 300LA rated bridge would be constructed over the existing arch, decommissioning the masonry arch from rail loading. The new bridge will be supported by a new substructure that would consist of reinforced concrete crossheads supported by bored piles located at an appropriate distance away from the existing abutment supports to not impact the structural integrity of the existing arch. No designs or costings have been completed however this is considered a viable option for a bridge nearing the end of its working tenure.

7.0 Heritage Impact Assessment

7.1 General

The proposed bridge remediation works will minimally impact the structure's fabric and appearance/external form. There will be no impact to footprint, layout. There will be minor impact to detailing and materiality.

7.2 Built Fabric

All original and significant building elements will be retained. However, the structure's built fabric will be minimally impacted by the dowel rods ties and concrete lining cutting into the basalt abutment. There will therefore be an aspect of impact to the materiality of the structure, however minimal.

7.3 Views

The works will adjust the appearance of the structure, the concrete lining will be a visible tier even though it will be tinted to match the overall bridge colour scheme. There will be negligible impact to views and sightlines within the site or external to it.

7.4 Assessment against VHR Significance Criteria¹¹.

The proposed works are discussed against the applicable heritage listing criterion in the below table – extracted from the VHR Entry.

Table 5.

VHR Criteria	Response
Criterion A: Importance to the course, or pattern of Victoria's Cultural History.	<p>The Midland Hwy Rail Bridge is significant as an architectural component within its context of the Castlemaine Railway Precinct. Castlemaine Railway Station is representative of Victoria's own 'Railway revolution'¹² that accompanied the Victorian Gold Rush and subsequent economic development of the State in the mid to late 19thc. It was built in the period of the 'main trunk lines' c.1857 - c.1869, also referred to as 'our great national lines of railway'¹³, the formative years of railway development in Victoria. The economic development that ensued from the general wealth created allowed regional communities to establish viable and sustainable economic bases, in turn promoted and enabled by the rail.</p> <ul style="list-style-type: none"> ▪ There is no impact to this criterion.
Criterion D: Importance in demonstrating the principal characteristics of a class of cultural places and objects.	<p>The Midland Hwy rail bridge and embankment is historically and architecturally significant to the State of Victoria within its context of the Castlemaine Railway Precinct. Sawmill Rd Bridge Castlemaine (HO684) is an almost identical design c. 5km to the north of Midland Hwy Bridge that conversely carries road traffic over the rail line and its stylistic/architectural associations with the bridges of Chewton Railway Station precinct. Similar to the Chewton rail over bridge (1864) (VHR H1780) the ornamentation and materials evidence the move away from the granite of the Taradale district to the characteristic brick and granite of the Chewton and Castlemaine section of the line.</p> <p>The bridge as it falls under Castlemaine Railway Station precinct is an intact representative example of a mid 19thc 'Boom period' Victorian Railway precinct. It is becoming relatively rare to locate structures of this scale and relatively intact</p>

¹¹ The Victorian Heritage Register Criteria and Threshold Guidelines https://heritagecouncil.vic.gov.au/wp-content/uploads/2019/05/VHRCriteriaandThresholdsGuidelines_2019Final.pdf

¹² Alderman, G. 1971. Review: The Victorian Transport Revolution, in The Historical Journal Vol.14, No.3 Sept. 1971 pp.635-644. Cambridge University Press

¹³ Ward A. 2019. A Story of Stations. The Architecture of Victoria's Railways in the 19thc. ARHS. pp121.

	<p>condition, that were once so important to local and regional communities, exemplifying past lifeways, before the invention of the automobile and its following large-scale adoption, and the modal changes that entailed.</p> <ul style="list-style-type: none"> There is minor impact to this criterion as the structure will be modified but remain essentially intact.
<p>Criterion E: Importance in exhibiting particular aesthetic characteristics.</p>	<p>The rail bridge is historically and scientifically significant as an integral part of the railway line and is an important representative component of what is regarded as one of the 'earliest and grandest capital works' projects in Victorian history and its association with the Chewton Castlemaine 'style'.</p> <p>Castlemaine Railway Station and precinct remains architecturally significant as a rare and relatively intact example of its own signature style (Ward 1982). The Midland Hwy Bridge is a significant and intact and working component of that precinct, particularly as it is characteristic of the architectural style and engineering solutions of the period of construction.</p> <ul style="list-style-type: none"> There is minor impact to this criterion as the structure will be modified but remain essentially intact.

7.5 Assessment against relevant Burra Charter Principles¹⁴

The following table assesses the proposed works against applicable conservation principles within the Burra Charter:

Table 6.

Burra Charter Article	Response
<p>Article 6: Burra Charter Process 6.2: Policy for managing a place must be based on an understanding of its cultural significance.</p>	<p>This document signifies that the proposed works have been informed by the Burra Charter process.</p>
<p>Article 16: Maintenance. Maintenance is fundamental to conservation. Maintenance should be undertaken where fabric is of cultural significance and its maintenance is necessary to retain that cultural significance</p>	<p>Maintenance of the bridge is important to the bridge ongoing viability as an integral structure and will allow its continuing use in its current form (without a potential modern superstructure over the top of the bridge - one of the discarded options) as this will significantly impact all heritage aspects of the bridge.</p>
<p>Article 22: New work 22.1 New work such as additions or other changes to the place may be acceptable where it respects and does not distort or obscure the cultural significance of the place, or detract from its interpretation and appreciation 22.2 New work should be readily identifiable as such, but must respect and have minimal impact on the cultural significance of the place</p>	<p>The proposed works are necessary remediation and will have minor visual impact on the Midland Hwy Bridge and other aspects of the precinct's significance. The proposed works will not significantly distort or obscure the cultural significance of the place or detract from its interpretation and appreciation. The proposed works are necessary remediation works and the concrete lining will be recessed (colour match tinting) but identified as contemporary work. Original/early building fabric and elements are protected and retained. This approach will help retain the significance associated with the original building fabric, by extending the longevity of the bridge in its current form without intrusive large scale contemporary additions, such as a superstructure, to facilitate and extend its use/operation.</p>
<p>Article 23: Retaining or reintroducing use. Retaining, modifying or reintroducing a significant use may be appropriate and preferred forms of conservation. This may</p>	<p>The required changes to significant fabric are minimal and allows the bridge to retain its integral use.</p>

¹⁴ Burra Charter 2013 <https://australia.icomos.org/wp-content/uploads/The-Burra-Charter-2013-Adopted-31.10.2013.pdf>

require changes to significant fabric, but this should be minimized.	
<p>Article 27. Managing Change</p> <p>27.1 The impact of proposed changes, including incremental changes, on the cultural significance of a place should be assessed with reference to the statement of significance and the policy for managing the place. It may be necessary to modify proposed changes to better retain cultural significance.</p> <p>27.2 Existing fabric, use, associations and meanings should be adequately recorded before and after any changes are made to the place</p>	<p>Proposed works are assessed against the Significance assessments in this document.</p> <p>Minor change will be evidenced with the concrete lining modifying the appearance of the structure.</p>

7.6 Heritage Impact Discussion

The Castlemaine Railway Precinct c.1862 (comprising the Midland Highway Rail-over bridge, Forest Creek viaduct, Forest Street rail-overbridge, Castlemaine Railway Station, and embankment) is historically and scientifically significant as an integral part of the railway line and is an important representative of one of the earliest and grandest capital works projects in Victorian history. It is directly associated with the formation of a state owned Victorian public transport service Victorian Railway Department.

In the mid-1850s the Victorian government decided to step in to construct the 'Murray Valley Railway' after private holdings - the Melbourne, Mount Alexander and Murray River Company - failed to raise sufficient funds to construct the line. The government's purchase of the company marked its embracement of the concept of a public railway system leading to the formation of the Victorian Railways Department in 1856 (Ward and Donnelly 1982:11). With a labour force of more than 6,000 men, it became Victoria's largest capital works project of the period.

With regards to engineering (scientific) significance the bridge and precinct is substantially intact and provides evidence of UK engineering and architectural standards of the period and the role of the Victorian Railway Department in developing the Colony's engineering expertise and the abundance of British emigre engineers (Ward 2019:20).

With regards to architectural significance, Castlemaine Railway Precinct is an important and intact example of a station complex on the line. Castlemaine Station is the template example of the 'Castlemaine' style of railway architecture borrowing the paternal model of British Railway design and aesthetic practices of the period (Ward and Donnelly 1982:54). The 'Castlemaine' style employs many Italianate features of the mid-Victorian period, (again derived from England 1845-1860) such as heavy rusticated quoining (a feature of Castlemaine Station buildings within the rail precinct and echoed at Forest Creek Bridge and Midland Hwy Rail Bridge), eaves corbelling and low hipped roofs. The two rail-overbridges, viaduct, and associated embankment are excellent examples of the range of materials, building techniques and design types used on the Kyneton to Bendigo section of the line. The precinct makes an important contribution in defining the character of the Victorian railway network at the time (Ward and Donnelly 1982:54).

With regards to aesthetics, in addition to its engineering, the bridge retains its solid original bi-chrome brickwork, stone quined and stone-dressed piers and abutments. The bridge together with the railway embankment, are important contributory aesthetic structures within the precinct.

Although there will be the loss of some original build fabric, (aesthetics, engineering) this will be receded allowing the bridge to continue to operate in its current form for another half century.

7.7 Mitigations

To comply with heritage management best practice, the proposed works are designed to minimize impacts upon the heritage place while meeting the architectural design brief to preserve the structural integrity of the bridge and preserve its overall materiality by addressing the structure's slow entropy – continual water damage, cracking along the soffit, falling bricks and mortar loss. The solution proposed is the least impactful to the structure, and most cost effective. The physical location and historical association of the bridge to the Castlemaine Railway Precinct is preserved by the proposed remediation.

8.0 Information to Support Assessment Against Sections 101 (2) and 101 (3) of the Heritage Act 2017

8.1 Impact of the proposal on the cultural heritage significance of the place or object

- *What will be the effect on the cultural heritage significance of the registered place or object if the proposal were to be approved S101 (2) (a)?*

Aside from intrusion/impact of the dowel and the cutting of the lining into original fabric there will be limited overall impact upon the heritage significance of the bridge. The concrete lining will be noticeable however it will be tinted to generally colour match the overall bridge colour scheme and so will be receded. The most positive impact is that the remediation will extend the life of the rail bridge by an estimated 50 years.

8.2 Matters for consideration by the Executive Director of Heritage Victoria under the Heritage Act 2017 S101 (2) and under their discretion.

Table 7.

Consideration	Response
What will be the effect on the reasonable or economic use of the registered place or object if the proposal were to be refused [S101 (2) (b)]?	The bridge's soffit has become safety critical and requires remediation to prevent falling bricks and mortar loss. If the proposed works are refused it is contingent from a safety critical perspective to surmise that the only alternative for V/Line would be to propose another remediation option like the MARSYS Helifix system or request that the bridge be replaced by a superstructure.
If the applicant is a public authority what will be the effect on the ability of the public authority to perform a statutory duty specified in the application if the proposal were to be refused S101 (2) (d)?	Because of water damage and age, the bridge is becoming safety critical, and requires remediation and waterproofing to protect its integrity. If the proposed works are refused it is contingent from a safety critical perspective to surmise that the only alternative for V/Line would be to propose another remediation option like the MARSYS Helifix system or request that the bridge be replaced by a superstructure.

An explanation of how all heritage fabric would be protected during the proposed works:	The heritage fabric will be impacted by the dowel rods and concrete lining cutting and will be covered by the concrete lining. No other impact is foreseen.
An explanation of whether the proposed works would fix the problem short/medium/long term:	The bridge is approaching end of its viable working life. The proposed works aim to address the bridge's viability issues (losing fabric and water damage) keeping the bridge in service for the foreseeable future (c.50 years) - when global warming no doubt will present other challenges.
A breakdown/explanation of whether the works are to impact original or introduced fabric:	The concrete lining/dowel rods will minimally impact the original fabric of the bridge soffit and upper abutment.
Whether any mitigating works were being proposed, eg. graffiti remedial works, conservation works, required maintenance works etc:	The bridge is inspected annually by V/Line Facilities Maintenance. Further, graffiti is noted and removed during these periods. There is currently (as of 2024) no graffiti on the bridge. The lining proposed for Midland Hwy will be colour matched to the bridge.
Render or photomontage showing the proposed works: Included in general online submission.	See Fig.14 for real world example of Chewton Rail Bridge - without proposed colour matching. Note that at Midland the concrete lining will not be installed down the abutment sides as at Chewton, only the bridge soffit. The lining proposed for Midland Hwy will be colour matched to the bridge.
All options that had been considered and why the preferred option was required:	The alternative options are as fabric impactful but more expensive (MARSYS-Helifix) without fastening the soffit bricks, or replacement of the bridge with a superstructure over it.
The preferred solution should require the least possible intervention to the heritage structure, both physically and visually:	The preferred solution is the equal least possible intervention physically, however visually the MARSYS system is more recessive. The MARSYS-Helifix solution however will not necessarily stop loss of fabric – falling bricks and other bridge elements. The concrete lining solution will secure all elements of the bridge.
Any introduced materials should be appropriate and sympathetic to the heritage structure and be visually recessive:	The proposed concrete lining is already present on the 1895 bridge extension, the new lining will match this.

Conclusions

The Midland Hwy Rail Bridge and embankment was built in 1862 for the Victorian Railways, at the time, the Murray Valley Railway was one of the Colony's first two main trunk lines. It is a red brick and basalt structure and consists of a single, depressed arch, with curved battered abutment walls. The masonry features a double buttress, voussoirs, wingwalls, single stepped string course, the bi-chrome brick and rusticated basalt quoining (characteristic of the Castlemaine Railway Precinct, including Forest Creek Rail Bridge and the Station building) and a parapet. It was based on the aesthetics of classical planning principles; the bridge design being directly derived from contemporary UK masonry techniques and designs of the 1840s and 1850s. An unreinforced concrete arch (1895) was added to the original red brick masonry arch bridge (1862) to widen the rail bridge in order to carry a third track to Maryborough Goldfields widening the entire structure to c. 13m.

The proposed remediation works will reinforce the red brick masonry arch bridge in this juncture of its working life and considerably extend this aspect (c.50 years), it will also make the bridge safe and protect its structural integrity. The proposed works have been considered and guided through conservation practice and design principles to ensure that the overall heritage significance of the bridge and the greater Castlemaine Railway Precinct will be retained and minimally impacted.

The landmark qualities of the heritage site, and its element aspect within the Castlemaine Railway Precinct are retained. As a result, the proposed works have minimal impact on the heritage significance of the place and on balance correspondingly satisfies the conditions of the Heritage Act 2017 (Vic).

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Appendix A – DTP Approval Notice



Department of Transport
and Planning

GPO Box 2392
Melbourne, VIC 3001 Australia
www.transport.vic.gov.au

Ref: DOC/24/284573

Heritage Victoria
Level 16, 150 Lonsdale Street
MELBOURNE VIC 3000

To Whom it May Concern

REMEDICATION/STRENGTHENING WORKS ON MIDLAND HIGHWAY BRIDGE, CASTLEMAINE

This is the statement of consent under section 92(3) or 93 of the Heritage Act 2017 (Vic) for an application to carry out works as part of the Regional Rail Sustainability Project, which includes Major Periodic and Routine Maintenance across the V/Line network.

V/Line are proposing to do remediation/strengthening works on the Midland Highway Bridge, Castlemaine. Works involve concrete lining of the bridge soffit as detailed in the Midland Highway Bridge Report prepared by SMEC dated 12 July 2024.

The Department of Transport and Planning has the Head Lease for operational railway land with VicTrack and is required to approve proposed works through the V/Line Service Level Agreement between the Department and V/Line.

As such, on behalf of the Department of Transport and Planning, I give consent to the applicant to carry out the works or activities specified in the Heritage Permit Application.

Yours sincerely

LEIGH BROMLEY
Director, Regional Rail

14 / 11 / 2024

cc: Greg Deftereos, V/Line

