LEVEL 3 BRIDGE INSPECTION AND LOAD RATING REPORT – MCCROWS ROAD BRIDGE

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MCCROWS ROAD BRIDGE

PREPARED FOR

ARARAT RURAL CITY COUNCIL

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1. INTRODUCTION

Arrart Rural City Council has requested Advanced Structural Consultancy (ASC) to undertake a Level 3 Bridge Inspection and condition rating of the Mccrows Road Bridge on Mccrows Road, between Estate Road and Parupa Road in Lake Bolac, Victoria. The three-span inverted U-slab bridge spans over Fiery Creek, with a total length of approximately 18.5m and a clear width of 6.1m between kerbs. The Level 3 inspection was carried out for all the structural elements of the bridge, expect for the piles below the water / ground level and the abutment crossheads, which were covered due to the batter protection.

The council has raised safety concerns regarding the displacement and tilting of the edge U-slab within the middle span, attributed to (recent) vehicle impact. Currently, the full width of the edge beam is not seated on the pier crosshead due to observed rotational displacement. Although no cracking or spalling has been identified in the edge beam under its present condition, the pier crossheads have reinforced concrete stoppers intended for lateral restraint of the bridge deck, which have sustained significant cracking and spalling as a result of the impact. It should be noted that no load or speed restrictions are currently enforced on the structure.

There are few previous engineering inspection reports available for this bridge. This report provides a Level 3 engineering inspection for the bridge, conducted on 20 October 2024, and has been collated in conjunction with the existing condition of the bridge. The report includes site inspection records, condition assessments of the bridge elements, observed defects, and recommended remedial work and potential strengthening to reinstate the bridge. The inspection was undertaken in accordance with the *VicRoads Structures Inspection Manual (2022)*.

The as-built construction drawings for this bridge have not been provided by the council. However, as-built drawings of a similar bridge have been provided by the council for reference to determine the structural capacity of the bridge. The 1961 standard inverted U-slab drawings were used to assess the load capacity of the bridge superstructure. The actual cross-section sizes and spans have been measured in the current condition. The reinforcement details from the reference bridges were used to determine the current load capacity of the bridge.

This report also identifies potential rehabilitation options to maintain and restore the structural integrity and increase the structural capacity of the bridge to meet the latest truck load requirements in accordance with AS 5100.2:2017

1.1 SCOPE

ASC did undertake the scope to complete a Level 3 bridge inspection, conduct a condition assessment, and perform a load rating analysis for the Mccrows Road Bridge. This assessment did include a load rating analysis and an evaluation of critical structural components to ensure compliance with 100% of the SM1600 load rating, as outlined in AS 5100.2-2017 and AS 5100.7-2017.

The specific activities ASC did include in the project scope are detailed as follows:

- ***Desktop Review**: ASC did conduct a desktop review of existing bridge information from available drawings to confirm geometry, layout, bridge extents, and joints.*

- ***Previous Reports Review**: ASC did review previously available inspection and condition assessment reports.*
- ***Detailed Visual Inspection and Defects Mapping**: A Chartered Professional Bridge Engineer did perform a detailed visual inspection and mapping of defects on all bridge components. The engineer did assess the approaches, joints, wearing surface, kerbs, on-structure barriers, abutments, piers, crossheads, U-Slabs, bearings/grout pads, batter protection, and waterways. The engineer did measure and document visible signs of chemical and physical weathering, including deterioration such as cracks, spalling, corrosion, construction defects, and physical damage from overloading, impacts, fire, floods, or scour.*

- ***Geometric Survey and Reinforcement Determination**: The bridge inspection team did conduct a geometric survey of visible bridge components and did determine the reinforcement arrangement of reinforced concrete elements using Ground Penetration Radar (GPR)*

- ***Load Rating Desktop Assessment**: ASC did conduct a desktop load rating assessment using Space Gass 14.11.2952 in compliance with AS 5100.7 (2017) bridge assessment provisions. This analysis did use as-built geometric survey data, GPR scanning, CRB standard drawings, drawings and inspection documents supplied by the council, and did consider any identified defects.*

  The Level 3 Bridge Inspection did refer to the latest standards and codes as follows:

- *AS 5100 Bridge Design*
- *AS 5100.2 Design Loads*
- *AS 5100.3 Foundations and Soil-Supporting Structures*
- *AS 5100.5 Concrete*
- *AS 5100.6 Steel and Composite Construction*
- *AS 5100.7 Rating of Existing Bridges*
- *AS 5100.8 Rehabilitation and Strengthening of Existing Bridges*

Further activities ASC did perform include:

- *Recommendations for Asset Management: Based on the Level 3 inspection and load rating, ASC did provide recommendations for asset management options available to the council, including any traffic load and speed limits if necessary.*
- *Determination of Strengthening and Rehabilitation Options: ASC did identify strengthening and rehabilitation options with associated approximate construction cost estimates, including replacement options for each item.*
- *Bridge Widening Options: ASC did determine bridge widening options along with approximate construction cost estimates.*

- *Recommendations for Additional Investigations: ASC did provide further recommendations for Non-Destructive Testing (NDT), Geotechnical Investigation, and Flood Modeling as needed.*
- *Level 3 Inspection and Condition Rating Report: ASC did prepare a comprehensive Level 3 bridge inspection and condition rating report. The report did include detailed photographs, a summary of findings, and a discussion of possible defect causes with corresponding recommendations. The report did follow the minimum requirements outlined in the VicRoads Road Bridge Inspection Manual, dated June 2022.*

1.2 ASSUMPTIONS AND QUALIFICATIONS

This assessment was conducted under the following assumptions and qualifications:

- *The load rating and condition assessment are limited to visible components and available documents.*
- *No geotechnical assessment / excavations were performed.*
- *No material testing is planned for this bridge, so the assessment was conducted in accordance with AS 5100-2017 standards to determine the material strengths.*
- *Lateral load analysis and load rating for lateral load are not included in this report.*
- *The substructure load assessment excludes assessment for instantaneous, earthquake and flood loadings.*
- *Differential temperature, differential creep and shrinkage were not considered in the design actions in accordance with AS5100.7, CL. 11.2.4.*
- *No hydrology/hydraulic, environmental, or barrier risk assessments were conducted as part of this Level 3 bridge inspection.*
- *A load distribution factor of 1.0, as specified in the VicRoads Road Structures Inspection Manual (2022), has been applied. This factor assumes that each individual U-slab bears 100% of the load from a single line of vehicle wheels. The rationale for adopting a load distribution factor of 1.0 is based on the absence of bolts connecting the U-slab units, the presence of water staining on the underside of the U-slabs, indicating potential shear key failure, and the lack of a / no concrete overlay.*

2. BRIDGE DESCRIPTION

Mccrows Road Bridge is a three-span, single carriageway road bridge spanning Fiery Creek, constructed in 1961 (GPS coordinates -37.730720, 142.930650). Each span is approximately 6 m long, providing a total deck length of 18.5 m. The overall width of the bridge is 6.45 m, and the skew is insignificant.

The bridge approaches and sealed pavements are in generally good condition, exhibiting no significant depressions or cracks. The expansion joints at the abutments and piers are completely covered with asphalt, and no substantial cracking has been observed. There is no evidence of recent movement in the expansion joints, indicating that there has been no significant foundation or abutment displacement. However, slight vegetation growth has been noted on both the structure and its approaches.

The superstructure comprises nine reinforced concrete inverted HSRC U-slabs and two curb units. It is important to note that the HSRC U-slab decks, installed in 1961, lacked a concrete deck or tie bolts, with the U-slab units spanning solely between the abutment and pier crossheads. These U-slab units are supported by grout pads positioned on the abutment and pier crossheads.

The on-structure barrier (W Beam) has sustained severe impact damage, resulting in the west edge beam of the second span shifting away from the adjacent U-slab segments and tilting slightly. Stoppers have been installed on top of the pier crosshead to provide lateral restraint to the bridge superstructure; however, these stoppers have also been significantly damaged due to the impact.

The substructure includes two abutments (A1 & A2), the continuous crossheads are supported by square (precast) reinforced concrete driven piles. There are two internal piers (P1 & P2) which includes continuous cross heads and four square reinforced concrete driven piles. All crossheads are reinforced concrete in-situ construction in 1961. Since the bridge drawings are not available to ASC, the pile lengths are unknown. The piles of the two abutments are fully covered due to batter protection, and the pile and span configuration of the abutments is assumed to be similar to that of the piers for load rating purposes.

The clear depth between the soffit of the existing deck and the creek bed varies from 1 m to 3.5 m.

The following table 1 summarises the available information on the bridge.

Description	**Measurement**
GPS Coordinates	-37.730738, 142.930644
Bridge Name	Mccrows Road Bridge
Road Name	Mccrows road
Waterway	Fiery Creek
Year of built	1961
Asset Owner	Ararat Regional City Council
Bridge Superstructure Type	1950s HSRC Inverted U-Slabs
Bridge Substructure Type	Reinforced Concrete Crossheads
Bridge Foundation Type	Precast reinforced concrete driven piles
Design Loading	Unknown
Overall deck length	18.5m
Typical Span (length of deck units)	6.2m
Deck overall width	6.4m
Traffic width	6.1m
No of Spans	3

3. SITE INSPECTION

On 20 October 2024, Geethika Sandaruwan and Shane Chamoda of Advanced Structural Consultancy conducted a detailed visual inspection of the structure. As the bridge has a medium height from the creek bed, all components were safely accessible on foot and with ladders to confirm the bridge geometry, measure structural components for assessment, and capture photographic evidence of any structural defects observed. Refer to Appendix A for defects mapping.

4. LOAD ASSESSMENT METHODOLOGY

The objective of this structural analysis and bridge assessment is to determine the current load-bearing capacity (Rating Factor, RF) of the bridge for specified vehicle types, in compliance with the current bridge design standard AS 5100:2017.

a. *MS18*
b. *45.5T HML Semi-trailer*
c. *68.0T HML B-double*
d. *42.5T GML Semi-trailer*
e. *62.5T GML B - double*
f. *T44 truck load*
g. *W7 - 72kN Wheel load*
h. *HLP320*
i. *HLP400*
j. *SM1600*
k. *W80*

Moving load classes as specified by AS5100.2 are used to detect the stringent case scenarios, and the so-called influence line concept is used to pass traffic load across bridge deck. The bridge capacities were calculated using in-house Excel spreadsheets. The load rating was carried out in accordance with Part 7 – Bridge Assessment, of the Australian Bridge Design code AS5100:2017.

4.1 DATA COLLECTION AND PREPARATION

Structural Plans: Obtain the bridge's as-built plans, structural drawings, design specifications, and previous inspection reports. These will provide necessary details on materials, dimensions, load paths, and components.

Material Properties: Define the properties of materials including the concrete and reinforcements used in the bridge, including strengths, elastic modulus, and yield stresses, in accordance with AS5100.7 2017.

Geometric Details: Input exact measurements of the bridge, including spans, U-slab spacing, infill gravel thickness, and other physical dimensions.

Bridge Condition: Gather information of deterioration, damage, or alterations that affect the bridge's strength.

4.2 MODELLING SOFTWARE

Structural Modelling and Design: The load assessment consists of load rating the bridge superstructure and substructure elements based on an assessment at ULS and SLS in accordance with AS5100.5-2017. In-house developed spreadsheets were used for the calculation of section properties and structural capacities respectively. Space Gass 14.11.2952 computer software was used to develop the model for analysis of the bridge. A 3D structural model including superstructure and substructure was developed to analyse the design actions on the structure elements. A linear elastic analysis was carried out to determine the design actions

4.3 LOAD FACTORS

The DLA, SLS and ULS factors for the referenced vehicles are in accordance with AS5100-2017 and Client's brief and area summarized in Table 2.

Load Type	DLA	SLS Factor	ULS Factor (Reduces Safety)	ULS Factor (Increases Safety)
Dead Load - Concrete	N/A	1	1.2	0.85
Dead Load – Earth Pressure	N/A	1.2	1.5	0.7
SDL – Asphalt	N/A	1.3	2	0.7
Live Load – SM1600	0.3	1	1.8	N/A
Live Load – T44	0.4	1	2	N/A
Live Load – MS18	0.4	1	2	N/A
Live Load - H20-S16	0.4	1	2	N/A
Live Load – Semi-trailer, B-double	0.4	1	2	N/A
Heavy Load Platform	0.1	1	1.5	N/A
Live Load - Surcharge	N/A	1	1.5	N/A

4.4 VEHICLE POSITIONING

As per requirements of AS/NZS 5100.7, the vehicle shall be positioned in the most onerous position within the carriageway for the section under consideration but no closer than 600 mm to the face of the kerb from centreline of the dual tyre.

4.5 LOAD RATING FACTOR CALCULATIONS

The load rating factor (RF) is calculated for a bridge and the nominated rating vehicle mentioned in modelling section.

$$RF = \frac{\text{Available bridge capacity for live load effects}}{\text{Live load effects of nominated rating vehicle}}$$

$$\phi R_u \geq \gamma_g S_g^* + \gamma_{gs} S_{gs}^* + S_p^* + S_s^* + S_t^* + \gamma_L (RF) S_L^* W (1+\alpha)$$

ϕ = capacity reduction factor
R_u = calculated ultimate capacity
γ_g= load factor for dead load
$S*_g$= load effects due to dead load
γ_{gs}= load factor for the superimposed dead load
$S*_{gs}$ = load effects due to superimposed dead load
γ_Q= traffic load factor
RF = load rating factor
$S*_Q$= load effects due to the traffic load used for the load rating
W = a factor representing ALF for road traffic bridges, that is, the accompanying lane factor
α = dynamic load allowance

$$RF \leq \frac{\phi R_u - \left(\gamma_g S_g^* + \gamma_{gs} S_{gs}^* + S_p^* + S_s^* + S_t^*\right)}{\gamma_L \left(1+\alpha\right) W S_L^*}$$

A rating factor of 1.0 or more indicates that the component in question complies with the requirements of AS5100.7-2017 and can safely carry the specified traffic loading. A rating factor of less than 1.0 implies that the bridge component is operating at a lower factor of safety than is typically required by the standard.

4.6 ASSUMPTIONS

The load assessment was based on the following assumptions.
Reinforced concrete density – 26kN/m3 (AS5100.7-2017)
Yield strength of concrete – 21MPa (AS5100.7-2017)
Yield strength of reinforcements – 230MPa (AS5100.7-2017)

4.7 LIMITATIONS

The bridge has been assessed for vertical loads only. Horizontal loads due to vehicle braking and traction force, flood loading, earthquake, lateral earth pressure and thermal effects have not been assessed. The assessment of pile foundation is not part of this assignment due to unavailability of geotechnical information.

5. RESULTS OF LOAD RATING

Table 3 summarises the rating factors for the structure's primary components under the vehicle configurations considered in the assessment, calculated in accordance with the method outlined in Section 4.

Live Load	U-Slab		Abutment Crosshead			Pier Crosshead		
	BM	SF	+BM	-BM	SF	+BM	-BM	SF
GML 42.5T	0.39	0.76	1.18	1.71	1.24	0.70	0.94	0.61
HML 45.5T	0.37	0.76	1.14	1.62	1.19	0.68	0.90	0.58
GML B-Double 62.5T	0.39	0.76	1.18	1.71	1.24	0.70	0.94	0.61
HML B-Double 68T	0.37	0.76	1.14	1.62	1.19	0.68	0.90	0.58
T44	0.39	0.66	1.03	1.38	1.05	0.56	0.72	0.46
W7	0.51	1.33	1.52	>2	1.63	1.31	>2	1.21
HLP320	0.57	1.04	1.08	1.30	0.89	0.60	0.68	0.39
HLP400	0.45	0.84	0.84	1.01	0.69	0.47	0.53	0.29
MS18	0.42	0.75	1.18	1.62	1.2	0.74	0.94	0.62
W80	0.45	0.99	1.31	1.82	1.42	1.13	>2	1.05
A160	0.45	0.99	1.31	>2	1.43	1.31	1.65	1.05
M1600	0.26	0.55	0.85	1.16	0.87	0.43	0.55	0.33

6. DISCUSSION

6.1 INTERPRETATION OF LOAD RESULTS

The results for the main girders were typically governed by the internal girders rather than the external girder. Bending effects were found to be more critical than Shear effects for deck units. The assessment results indicate that the bridge is essentially deemed to be inadequate for any heavy vehicles.

The inadequate results for the U-slabs in Bending capacity for the loads considered are driven by the inherent design limitation of the original U-slab units specifically, lower material strength and no shear keys or leg tie-bolts to provide transverse load distribution between adjacent units. The results are appropriate and reasonable and in alignment with documented limitations and performance issues for these consistence with the Country Roads Board (CRB) units of the 1960s era (refer VicRoads Road Structures Inspection Manual). Simply put, these units were not designed to carry heavy vehicles such as those assessed.

While the bridge has not exhibited structural failure under vehicle passage, the analysis indicates that U-slab members are experiencing significant stress. Prolonged overstressing of these elements is likely to accelerate the rate of structural deterioration, underscoring the importance of load management to extend the bridge's service life.

The theoretical shortcoming in Bending capacity of the pier crossheads is driven by the fact that the crosshead is not particularly deep at 457mm D x 457mm W, and because the drawings are not available the assessment assumed only 21MPa as per AS5100.7 CL A1.4. Similarly, the headstock is fairly lightly reinforced, and no steel strength is available, so 230MPa was adopted in accordance with AS5100.7 Table A5. Furthermore, the heavy vehicles assessed are generally comprised of a greater number of heavier axles than the design loading of the era (H20-S16) meaning that a greater load effect is imparted onto the intermediate piers when a longer vehicle(s) loads both spans at once. These aspects limit the available strength to be calculated for the headstock. If actual materials strengths were found to be greater than the strength properties assumed and based on AS5100.7, then the capacity may be slightly increased and improve results.

The pier headstocks exhibit significant concrete spalling and corrosion of reinforcing steel, resulting in a substantial reduction in shear load rating capacity. Implementing concrete repairs and reinstating the corroded reinforcement in accordance with AS 5100.8:2017 is expected to enhance the shear load rating, as outlined in Table 4.

However, given the severity of the inadequate rate factors, it is considered unlikely that higher material strength would result in passing assessment results.

These results are based on the worst-case scenarios of the vehicle travel positions summarised in the Vehicle Configuration Summary table and depicted in the Vehicle Configuration Diagrams, and these positions are based on a pragmatic review of the carriageway trafficable width, marked lanes, AS5100 design lanes and reasonable spacing between passing vehicles.

Geotechnical data and detailed specifications for the precast driven piles are unavailable, limiting the ability to accurately determine load ratings for the foundations. Considering the bridge's age, it is reasonable to assume that most long-term settlements have already occurred, potentially enhancing its current load-bearing capacity. However, in the absence of specific foundation details, it is recommended that all lateral loads induced by braking and acceleration be transferred to the engineered fill behind the abutment headstock. This approach aims to mitigate the risk of overstressing the piles.

The anticipated improvement in the shear load rating, upon rectification of the pier crosshead to meet its original design capacity, is presented in Table 4.

Live Load	Pier Crosshead		
	+BM	-BM	SF
GML 42.5T	0.99	1.38	0.84
HML 45.5T	0.96	1.33	0.81
GML B-Double 62.5T	0.99	1.38	0.84
HML B-Double 68T	0.96	1.33	0.81
T44	0.79	1.07	0.63
W7	1.85	>2	1.66
HLP320	0.85	1.01	0.55
HLP400	0.66	0.78	0.41
MS18	1.04	1.38	0.85
W80	1.59	>2	1.44
A160	1.59	>2	1.44
M1600	0.60	0.81	0.47

6.2 SHORT-TERM RISK CONTROL STRATEGIES TO IMPROVE ACCESS PROVISIONS

The bridge has been in service for approximately 63 years which more than half of its assumed design life. In the current condition, the bridge appears to be in fair to poor condition and requires upgrading to achieve the desired level of service. The following short-term measures are recommended for the structure: high-priority repairs should be carried out within 1 to 3 months, and medium-priority repairs should be completed within 6 to 12 months to prevent more costly repairs in the future.

- The council should consider implementing a 15-tonne load limit to reduce the risk of further damage to the bridge until strengthening measures are in place. This restriction would exclude heavy vehicles such as semi-trailers and B-doubles, while still allowing access for most emergency service vehicles. (High Priority)

- A 3-month inspection cycle should be implemented to monitor concrete spalling until rectification of the pier crossheads and edge beam is completed. (High Priority)

- The pier crossheads exhibit moderate to severe aging cracks, attributed to low concrete cover and significant cross-sectional loss of reinforcement. All deteriorated concrete and corroded reinforcement should be removed and replaced with high-ductility N-grade reinforcement. Where lap length is unachievable, the new reinforcement should be welded to the existing bars. Standard concrete patch repairs are to be conducted in accordance with VicRoads specifications. The repaired crossheads should meet or exceed the original design capacity. (High Priority)

- The edge U-slab unit should be repositioned to its original location, ensuring it fully seats on the pier crosshead across the entire width of the edge unit. (High Priority)

- Severe concrete spalling and cracks, in addition to minor spalling, were observed on the U-slab units. All deteriorated concrete and corroded reinforcement should be removed, with standard concrete patch repairs carried out to rectify the U-slab deck. All corroded reinforcement should be replaced by welding N-grade reinforcement to the existing bars. (High Priority).

- The pier crosshead and stoppers were damaged due to vehicle impact. All loose concrete to be removed and reinstate stopper by dowelling into the existing crosshead. (High Priority)

- The bridge on-structure barrier shows multiple impact damages due to vehicle collisions. Damaged W-beams should be replaced, and the barrier reinstated in accordance with VicRoads specifications. (High Priority)

- Some piles exhibit moderate to severe corner bar splitting, potentially caused by inadequate concrete cover or low cement content in the concrete. As previously mentioned, all deteriorated concrete should be removed, corroded reinforcement replaced with N-grade reinforcement, and the affected areas patched with approved concrete repair material. (Medium Priority)

6.3 LONG-TERM RISK CONTROL STRATEGIES TO IMPROVE ACCESS PROVISIONS

The load distribution factor is a critical parameter in determining the rating factors for the overall bridge structure. According to the VicRoads Road Structures Inspection Manual 2022, if U-slab units are designed to act integrally and shear keys or bolts are in satisfactory condition, the load distribution factor may be reduced to 0.47. In this scenario, all rating factors for MS18, GML, HML and T44 vehicle classes would meet or exceed 1.0 for the bridge superstructure.

However, given the site conditions, there is insufficient evidence of reliable load distribution between U-slab units, as observed in the absence of effective shear connections. Consequently, a load distribution factor closer to 1.0 has been applied, which results in rating factors below 1.0 for the assessed vehicle loadings.

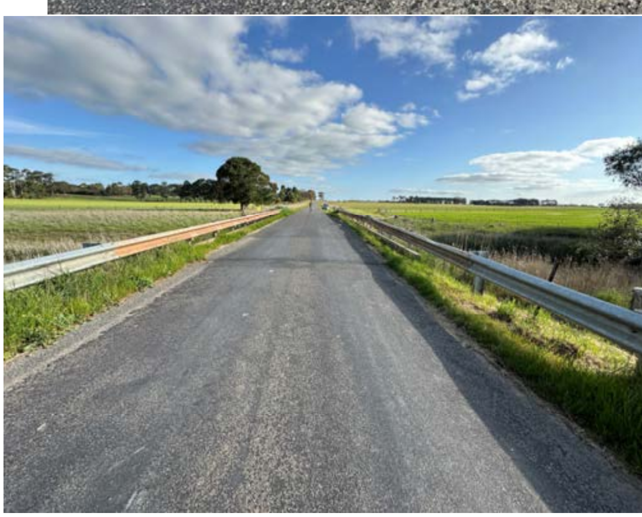
To upgrade the superstructure capacity to meet MS18, GML, HML, and T44 loadings with latest load and dynamic factors, a reinforced concrete overlay with chemset reinforcement dowels to the existing U-slab units to provide composite action. This deck overlay would enhance load distribution across U-slabs, increase the load-carrying capacity of individual U-slabs, and improve structural durability of both superstructure and substructure by reducing water infiltration. This will further improve the load distribution to the abutments and pier crosshead in resulting increasing the load rating factors for the substructure.

The addition of a concrete overlay will increase the dead load on the pile foundations, thereby impacting the foundation’s load rating. In the absence of detailed information on the existing driven piles and relevant geotechnical data, the current capacity and load rating of the foundation remain indeterminate. Obtaining the reduced levels of the existing crossheads at both abutments and piers would be highly advantageous. These measurements would serve as baseline data to facilitate the monitoring of any bridge movement, settlement, and any further settlement arising from increased dead or live loads in the future. Should the council opt to apply a reinforced concrete overlay to the existing U-slab, ongoing monitoring of foundation settlement is recommended until additional settlement stabilizes.

7. DEFECTS MAPPING

1. The northern approach exhibits minor depressions and cracking in the carriageway. Monitor at level 1 inspections.

2. The northern approach carriageway has experienced minor settlement, resulting in a rough joint at the north abutment. The expansion joint is entirely obscured by the wearing surface. Additionally, vegetation growth has been observed on the bridge deck. Monitor at Level 1 bridge inspection.



3. Impact damage has been observed due to vehicle collision resulting significant damage to the W-beam.

On-structure barrier – West

4. Minor damaged has been observed on the southern carriageway.

Minor damage to the southern pavement

5. Severe to moderate cracking and concrete spalling have been observed in all three spans. Evidence of severe to minor corrosion is present. All cracks appear to be aging cracks, and no flexural or shear cracks have been observed.


U-slab 2 – Span 3


U-slab 1 – Span 3


U-slab 2 – Span 3


U-slab 4 – Span 3


U-slab 8 – span 3


U-slab 9 – span 3


U-slab 9 – span 3


U-slab 9 – span 3

6. Severe to moderate cracking and concrete spalling have been observed on the pier crossheads. Evidence of moderate to severe corrosion is present. All cracks appear to be aging cracks, and no flexural or shear cracks have been observed.


Pier 1 - Crosshead


Pier 1 - Crosshead


Pier 1 - Crosshead

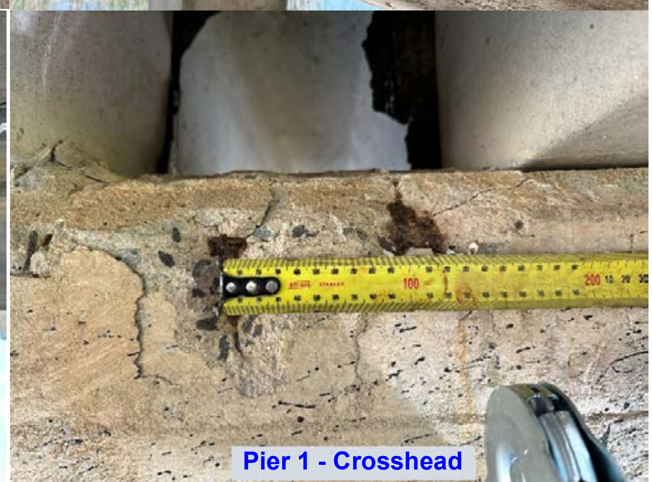

Pier 1 - Crosshead

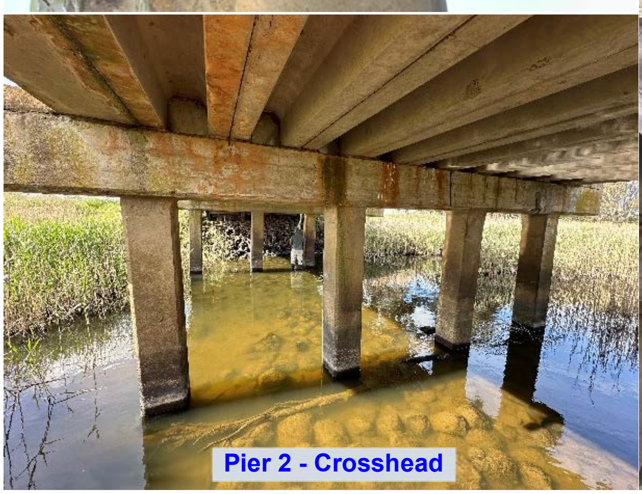

Pier 1 – Crosshead


Pier 1 - Crosshead


Pier 1 - Crosshead


Pier 1 - Crosshead


Pier 1 - Crosshead


Pier 2 - Crosshead


Pier 2 - Crosshead

7. The edge U-slab unit in span 2 is tilted and does not fully seat on the pier crosshead.

8. The stoppers and pier crosshead are damaged due to the impact from the vehicle collision.

9. Heavy stains have been observed between the edge and first interior U-slab units due to water leaks. This could impact the long-term durability and performance of the U-slab units.

10. Moderate to severe cracks have been observed on forth pile of pier 1.