HARRISON INFRASTRUCTURE GROUP

ROAD SAFETY AUDIT

DETAILED DESIGN STAGE

North Burnett Regional Council

Wetheron Road, Wetheron

Bon Accord Bridge Upgrade and Approach Works

Road Safety Audit No: HIG-RSA-0230

Document control sheet

Prepared by	Owen Deighton
Title	Senior Registered Road Safety Auditor
Location	HIG Bundaberg
Project No.	P11119
Version date	17/09/2024

Contact for enquiries and proposed changes:

If you have any questions regarding this document or if you have a suggestion for improvements, please contact:

Contact Officer	Owen Deighton
Title	Executive Designer, HIG Bundaberg
Phone	(07) 4151 8639

Version history

Version No.	Date	Changed By	Nature of Amendment
1	18/07/2024	Owen Deighton	Initial Draft
2	22/07/2027	Chantelle Nagel	Draft Issued to MCE
3	23/07/2024	Chantelle Nagel	Signed final report
4	17/09/2024	Chantelle Nagel	Version 2

Table of Contents

Supplied Data

1. CRC00319 Bon Accord Bridge Approaches-Rev5-IR1 (Issue for Tender).
2. CRC00319 Bon Accord Bridge Approaches Design Notes.
3. CRC00319 Bon Accord Bridge Approaches SID Report.
4. CRC00319 Bon Accord Bridge Approaches SID Register.
5. TRS_WRD - 2123 - BON ACCORD - IFC DRAWING SET [240528] FINAL.
6. TRS_WRD - 2123 - Bon Accord Final Design Brief - 07 Feb 2024.
7. TRS_WRD - Bon Accord - Final SiD - 07.02.2024.
8. WRD - Substructure Investigation Report.
9. WRD - Bon Accord Bridge - Final Level III Bridge Inspection Condition Report.

Site Map

Figure 1 : Project Site – Bon Accord Bridge, Wetheron Road, Wetheron

1. Introduction

This report represents the findings of a desktop "Detailed Design: Road Safety Audit" of the upgrade of the Bon Accord Bridge and approaches. The works are on Wetheron Road at Barambah Creek, Wetheron. This audit has been completed at the request of Lachlan McMurtrie, Director, McMurtrie Consulting Engineers.

The objective of the audit was to identify safety risks and hazards within the detailed design information provided. The information was compiled utilising the Austroads Guide to Road Safety Part 6A – Implementing Road Safety Audit (2022).

The Audit team comprised of:

- Owen Deighton, (Registered Senior Road Safety Auditor)
  Executive Civil Designer, Harrison Infrastructure Group, Bundaberg
- Chantelle Nagel, (Registered Road Safety Auditor)
  Principal Civil Designer, Harrison Infrastructure Group, Bundaberg

2. Road Safety Auditing

Road safety auditing is a formal procedure, which can be applied to all phases of road development projects and to existing roads. There are four stages of road design audit namely, Feasibility, Preliminary Design, Detailed Design and Pre-Opening. Detailed Design and Pre-Opening Stage audits are two stages which are performed more regularly. A Road Safety Audit is structured to review the safety performance of a road project but is not intended as a prescription for redesign. The reporting procedure is intended to outline potential or existing road safety issues.

The objectives of a road safety audit are:

- To provide an independent assessment of the constructed project from a road safety perspective;
- To review the constructed road environment and identify any safety related issues;
- To look beyond the project limits and consider the effects in transition areas;
- To identify potential safety problems of a particular section of road; and
- To ensure that measures to eliminate or reduce the problems are considered fully by the asset owner.

The procedures set out in Austroads Guidelines, Guide to Road Safety, Part 6 and Part 6A: Managing Road Safety Audits and Implementing Road Safety Audits, has been followed in undertaking this road safety audit. However, the auditors point out that no guarantee is made that every deficiency has been identified.

The recommendations contained within this report are only a guide, and in no way limit the actions, which be adopted by the responders, or oblige the responders to take action at this point in time. Upon receiving the report, the Client shall review the identified issues and develop responses for inclusion in the Action Plan to each of the issues raised in this report, including reasons for no remedial action.

The audit findings and recommendations have been presented in tabular format in Section 12 of this report. This section will also be provided in electronic format to allow development of the Action Plan.

3. Safe System

The identification and removal or treatment of road elements which may contribute to crash occurrence or crash severity is a key component of the safe system (Figure 2) approach to road safety. A safe system acknowledges that human error within the transport system is inevitable, and that when it does occur the system makes allowance for these errors to minimise the risk of serious injury or death. In a safe system, therefore, roads (and vehicles) should be designed to reduce the incidence and severity of crashes when they inevitably occur.

The safe system approach requires, in part (Australian Transport Council, 2006):

- designing, constructing and maintaining a road system (roads, vehicles and operating requirements) so that forces on the human body generated in crashes are generally less than those resulting in fatal or debilitating injury
- improving roads and roadsides to reduce the risk of crashes and minimise harm: measures for higher speed roads including dividing traffic, designing ‘forgiving’ roadsides, and providing clear driver guidance. In areas with large numbers of vulnerable road users or substantial collision risk, speed management supplemented by road and roadside treatments is a key strategy for limiting crashes
- managing speeds, taking into account the risks on different parts of the road system.

Figure 2 : Safe System Framework

4. Background

The Bon Accord Bridge on Wetheron Road was damaged during a severe flood event of the Burnett River in January 2022. The road approaches and banks of the river where undermined and sustained extensive damage.

This project has been identified to reinstate the Bon Accord bridge and upgrade the road approaches through utilisation of the existing bridge substructure. This will allow the Wetheron Road link to be reopened to motorists.

5. Entrance Meeting

No formal entrance meeting was held.

6. Exit Meeting

No formal exit meeting was held.

7. Site Inspection

A site inspection was undertaken by the audit team on the day and night of 16 September. Conditions were clear and a near full moon observed.

The audit team also utilise aerial imagery (Queensland Globe) and Street View (Google Earth) to identify potential hazards at the existing interface.

At the time of the site inspection the bridge works had been mostly completed. The road remains closed to the public and the bridge approach works are yet to be constructed.

8. Prioritising of Findings

8.1 Methodology

Ranking the findings of this road safety audit have been based on engineering judgement in conjunction with a risk approach based on identifying the hazard probability and the hazard severity. These will be combined to arrive at the resultant level of risk as detailed in the tables below.

Table 1: How often is the problem likely to lead to a crash?

Likelihood	Description
Almost Certain	One Per Quarter
Likely	Quarter to 1 Year
Possible	1 to 3 Years
Unlikely	3 to 7 Years
Rare	7 years +

Table 2: What is the likely severity of the resulting crash type?

Severity	Description
Fatal	Death within 30 days of the crash
Serious	Admitted to Hospital
Moderate	Major first aid and/or presents to hospital (not admitted)
Minor	Minor first aid
Insignificant	Property Damage

Table 3: The resulting level of risk

	Almost Certain	Likely	Possible	Unlikely	Rare
Fatal	**Extreme**	**Extreme**	**Extreme**	**Extreme**	**High**
Serious	**Extreme**	**Extreme**	**High**	**High**	**Medium**
Safe System Crash Outcome Threshold					
Moderate	**High**	**High**	**High**	**Medium**	**Low**
Minor	**High**	**Medium**	**Medium**	**Low**	**Negligible**
Insignificant	**Medium**	**Medium**	**Low**	**Negligible**	**Negligible**

8.2 Priority

A priority rating approach has been utilised to rank each recommendation; these priorities are listed below:

- **Negligible** – No action required.
- **Low** – Should be corrected or the risk reduced if the treatment cost is low.
- **Medium** – Should be corrected or the risk significantly reduced, if the treatment cost is moderate, but not high.
- **High** – Should be corrected or the risk significantly reduced, even if the treatment cost is high.
- **Extreme** – Must be corrected regardless of the cost.

9. Audit Findings

This section outlines issues that have been identified during the detailed design phase road safety audit. Actions have been suggested for the identified issues, as a guide for the selection and implementation of remedial measures. However, this does not imply that the suggested actions are the only possible actions. Issues have been identified that form both short term immediate action that may be carried out to reduce the likelihood of a safety incident as well as more permanent long-term solutions that provide a safer environment for the future in particular with the likely trend for traffic growth.

It should be noted that the opinions expressed in the following sections are those of the audit team based on the supplied and sourced information.

9.1 Geometry

9.1.1 Approach Geometry

The combination of horizontal and vertical alignment approaching Barambah Creek (Bon Accord Bridge) from both east and west severely restricts sight distance, giving motorists little forward awareness of the tight vertical alignment, narrowing cross section and vision to oncoming vehicles. Motorists also cannot identify if water is flowing over the road.

It is important that adequate approach sight distance be provided to allow motorists time to recognise the change in road conditions, oncoming vehicles or water over the road, and slow down, react and stop if necessary.

Poor sight distance increases the risk of loss of control, run off road and head on crashes at this location.

Figure 3: Eastern Approach to the Bon Accord Bridge (Continuous Side)

Figure 4: Western Approach to the Bon Accord Bridge (Give Way Side)

Risk Ranking Decision Process: *Frequency: Unlikely, Severity: Serious, Risk: High.*

Risk Ranking: High

Recommendation:

- Check stopping sight distance parameters to ensure that sufficient sight distance is available for the following conditions:
    - To oncoming vehicles crossing the bridge.
    - To floodwater overtopping the roadway at maximum likely flood height.
- Improve available visibility by excavating the existing cuttings on the inside of both approaches to the bridge.

If sufficient sight distance is not achieved, consider:

- Installing reduce speed signs (G9-9).
- Installation of VAS "slow down" signage on the western approach.
- Undertaking a speed review and implement a regulatory reduced speed limit over the bridge and approaches.

9.1.2 Horizontal Curve

The civil design drawings show the horizontal curve on the western approach to the bridge has the spiral/ transition extending into the bridge (approx. 30m). However, the bridge design drawings have not adopted the curved alignment for the initial section of the bridge. This will result in a mismatch of the centre of the roadway at the start of the bridge resulting in an angle change. Poor alignment connection from the roadway to the bridge may increase the risk run off road crashes.

Risk Ranking Decision Process: *Frequency: Unlikely, Severity: Serious, Risk: High.*

Risk Ranking: High

Recommendation:

- Review the road alignment to match the bridge abutment coordinates and bridge bearing provided in the bridge design drawing set.

9.2 Delineation

9.2.1 Guide Posts

The design drawings do not indicate the installation of guideposts as part of the project. The approaches to the bridge has insufficient guideposts to delineate the edge of the roadway to help guide motorists, especially at night. Poor delineation increases the risk of motorist failing to identify the road geometry and increasing the risk of loss of control, run off road and head on type crashes.

Figure 5: Delineation on bridge at 16 September 2024

Risk Ranking Decision Process: *Frequency: Unlikely, Severity: Serious, Risk: High.*

Risk Ranking: High

Recommendation:

- Consider the installation of guidepost on the approach curves to the bridge in accordance with AS 1742.2:2022 MUTCD Part 2.
- Consider reduced spacing of guideposts due to known fogs in the area.
- Consider the installation of RRPM's on linemarking on the bridge to improve nighttime delineation of the roadway.

9.2.2 Linemarking

The design drawings do not indicate if edge lines are to be painted across the bridge. AS 1742.2:2022 MUTCD Part 2 indicates that edge lines shall be provided for one-way bridges that are greater than 60m in length. The exclusion of linemarking increases the risk of motorists failing to drive in the middle of the bridge, striking the bridge kerbs and motorists thinking it is still a two-way bridge.

Figure 6: Existing Bridge No Linemarking

Risk Ranking Decision Process: *Frequency: Unlikely, Severity: Serious, Risk: High.*

Risk Ranking: High

Recommendation:

- Consider the installation of edge lines across the bridge in accordance with AS 1742.2:2022 MUTCD Part 2.
- Consider the installation of RRPM's on linemarking approaching and on the bridge to improve nighttime delineation of the roadway.
- Consider installation of edge lines with 4.0m between edge lines along the bridge in accordance with AS 1742.2:2022 MUTCD Part 2 Figure 4.11.
- Consider providing chevron markings to the shoulder areas on the bridge to clearly show that the bridge is one lane only.

9.2.3 Advisory Speed Signage

The road approaches to the bridge have substandard horizontal curves for the posted 100km/h, Wetheron Road. The western approach has an R220m radius curve while the eastern approach has an approx. R360m curve. The Design Notes provided indicate that the respective design speeds for the horizontal curves are 80km/h for the R220m and 100km/h for the R360m. The design drawings however have incorporated "Turn" W1-1 warning signs with 40km/h advisory speed signs. These horizontal elements are not tight enough to warrant the excessively low advisory speed plates. Regular users of the roadway will learn that the roadway can be driven at higher speeds and create a speed differential to motorist not common with the roadway. This increases the risk of crashes on the bridge approaches.

Risk Ranking Decision Process: *Frequency: Unlikely, Severity: Serious, Risk: High.*

Risk Ranking: High

Recommendation:

- Consider carrying out a Vericom assessment of the roadway to determine the correct advisory speed to display.
- Consider undertaking a speed review and implement a regulatory reduced speed limit across the bridge and approaches if a lower speed (advisory 40km/h) is required to achieve sight distance capabilities.

9.2.4 Signage Spacing

The design drawings show existing signage that is to remain and new signage to be installed on the western approach to the bridge. This signage is insufficiently spaced (refer figure 6 below). The "Give Way Ahead" sign has been positioned at the absolute minimum separation to the give way sign. The approach to the give way is on a 10% down grade and will require greater stopping distance (refer figure 7 below). This increases the risk of motorists being unable to comprehend all signage information and result in overshooting the giveway and crashing head on with oncoming traffic on the single lane bridge.

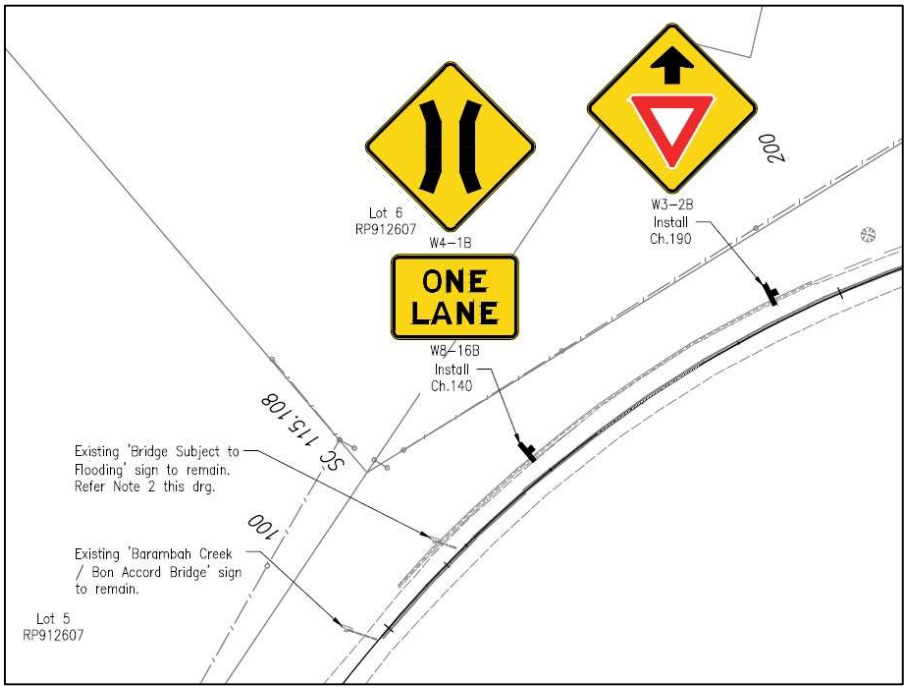

Figure 7: Existing and New Signage

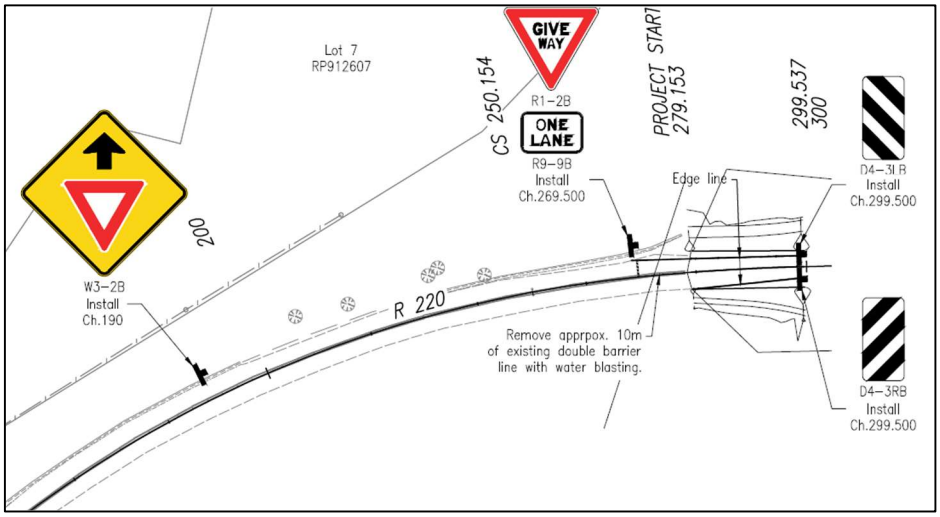

Figure 8: Sign Separation

Risk Ranking Decision Process: *Frequency: Unlikely, Severity: Serious, Risk: High.*

Risk Ranking: High

Recommendation:

- Consider providing sufficient separation between all signage on the approaches to the bridge.
- Consider providing a greater separation between the "Give Way Ahead" and "Give Way" signs to provided sufficient time for motorist to comprehend and react on the 10% decline.

9.2.5 Non-Standard/ Poor Condition Signage

The design drawings indicate that an existing "Bridge Subject to Flooding" warning sign is to remain. The sign referenced is in poor condition (based on Google Street View 2021) and is a non-standard sign, increasing the risk of motorist's confusion and lack of understanding of the upcoming hazard.

Figure 9: Existing "Bridge Subject to Flooding" Sign

Risk Ranking Decision Process: *Frequency: Unlikely, Severity: Moderate, Risk: Medium.*

Risk Ranking: Medium

Recommendation:

- Consider removing the existing sign that is in poor condition and install current standard road subject to flooding signage inclusive of flood depth indicators in accordance with AS 1742.2:2022 MUTCD Part 2.

9.2.6 Bridge Loading Limit Signage

It is acknowledged that the bridge is designed to meet a T44 loading allowing a loaded semi-trailer to traverse the bridge. Due to the 100m length of the bridge consider impact of multiple semi-trailers traversing the bridge simultaneously. If the bridge design does not allow for this scenario, consider installing load limit signage. Also consider the constraints that the designed bridge loading may have on access for future larger heavy vehicles. Excess loadings on the bridge may risk damage to the structure and reduce bridge life.

Risk Ranking Decision Process: *Frequency: Unlikely, Severity: Insignificant, Risk: Low.*

Risk Ranking: Low

Recommendation:

- Consider the need to install bridge loading limit signage on the approaches to the bridge.

9.3 Hazards

9.3.1 Kerb

The typical cross sections show proposed new kerbing on the approach to the new bridge. The location shown is positioned in the middle of the road shoulder. The proposed location is not detailed anywhere else within the drawing set. If the new kerbing is to be introduced mid shoulder, there is a risk that motorists could strike the end of the kerb increasing the risk of loss of control crashes.

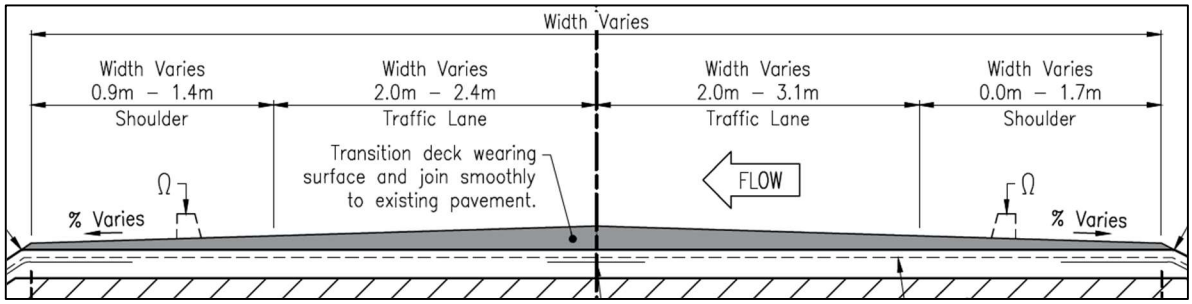

Figure 10: Cross Section with Proposed New Kerbing

Risk Ranking Decision Process: *Frequency: Unlikely, Severity: Serious, Risk: High.*

Risk Ranking: High

Recommendation:

- Consider updating plans to detail full kerb setout.
- Consider introducing kerbing at the edge of the sealed formation and transitioning down to the bridge kerb width.

9.3.2 Bad Weather

It was brought to the auditor's attention that the Bon Accord bridge site experiences fogs at times impacting on motorists' visibility. The lower visibility conditions could result in poor decision making by motorists entering onto the one lane bridge especially if motorists do not have their headlights on.

Figure 11: Fog along Bon Accord bridge

Risk Ranking Decision Process: *Frequency: Unlikely, Severity: Serious, Risk: High.*

Risk Ranking: High

Recommendation:

- Consider the need to install Warning Sign "Heavy Fog Headlights on for Safety" TC1733 on the approaches to the bridge.

9.4 Constructability

9.4.1 Deck Wearing Surface

The design proposes to transition and feather out the new bridge deck wearing surface to the approach concrete slabs. Deck wearing surfaces need to be laid to a minimum thickness and cannot be feathered out to a zero thickness. If placed as shown within the design drawings, there is a risk that the wearing surface could delaminate from the concrete approaches during flood events resulting in a rough road surface, increasing the risk of loss of control crashes.

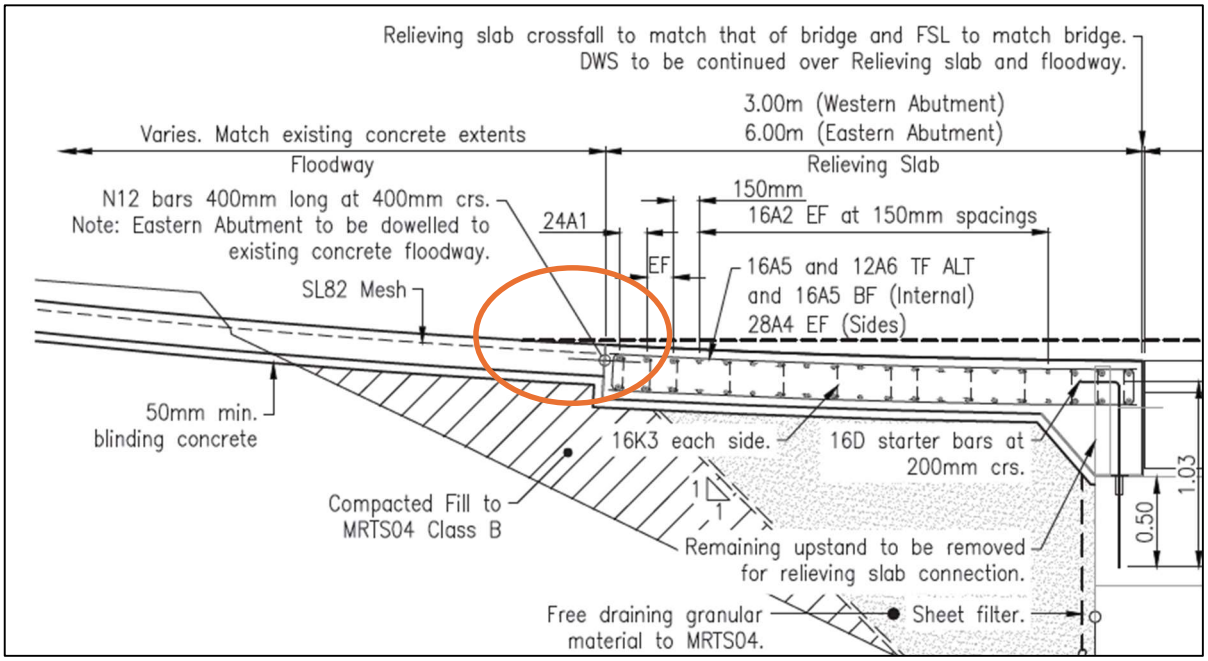

Figure 12: Feathering of Deck Wearing Surface

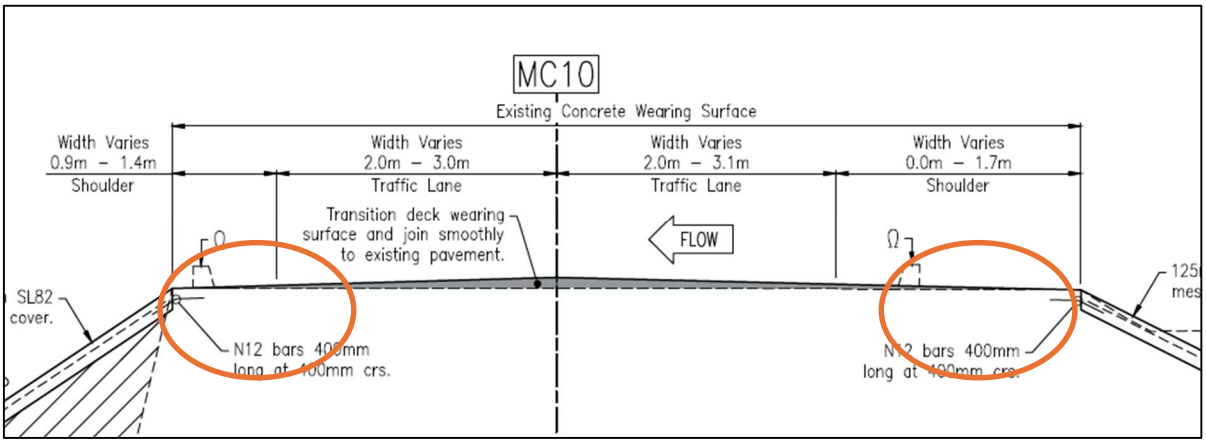

Figure 13: Feathering of Deck Wearing Surface

Risk Ranking Decision Process: *Frequency: Unlikely, Severity: Serious, Risk: High.*

Risk Ranking: High

Recommendation:

- Consider keying the deck wearing surface into the concrete approaches, or
- Consider amending the road grading on the approaches to the concrete slabs to allow for a minimum thickness wearing surface layer to be applied over the concrete approaches to the bridge, or
- Consider constructing the approach concrete slabs flush to the new bridge relieving slab profile with minimum depth deck wearing surface.

9.4.2 Cross Section Profile at Start of Project

The design cross sections show that the new design profile does not match the existing road shape at the start of the project. If the new construction matches the design plans there will be a rough connection to the existing roadway at the start of the project that increases the risk of loss of control crashes.

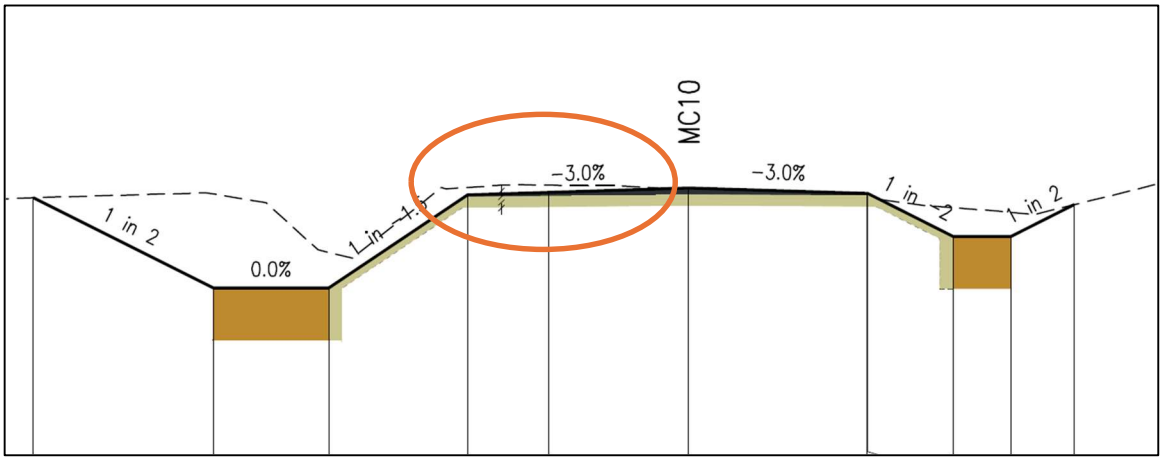

Figure 14: Cross Section at Start of Project

Risk Ranking Decision Process: *Frequency: Unlikely, Severity: Serious, Risk: High.*

Risk Ranking: High

Recommendation:

- Ensure that smooth connections are provided between existing and new work.
- Ensure that design standards are adhered to for rotations of road crossfall to match at tie in locations.

10. Recommendations

This detailed design road safety audit is for the Bon Accord bridge upgrade and approach works on Wetheron Road, Wetheron. The audit has identified several safety matters for consideration. These matters have been discussed in the preceding section and recommendations suggested.

The suggested actions are not intended to be the only possible actions and have been provided as a guide only for remedial action. The responsibility for the selection and implementation of the recommendation's rests with the Client and they should decide the appropriate actions and remedial measures for the identified issues.

11. Audit Team Statement

This road safety audit was carried out by the audit team using issued drawings sets, design reports and Google Street View. Every effort was made to ensure that all the safety issues were considered.

The above safety audit findings and recommendations are the opinion and the judgement of the audit team.

Owen Deighton

Owen Deighton, Registered Senior Road Safety Auditor

Executive Designer, HIG Bundaberg

Chantelle Nagel

Chantelle Nagel, Registered Road Safety Auditor

Principal Designer, HIG Bundaberg

Date: 17 September 2024

12. Corrective Action Report

Bon Accord Bridge Upgrade and Approaches, Wetheron.

Clause No.	Audit Findings	Risk Level	Audit Recommendations	Project Manager Accept: Yes or No	Design RPEQ Reasons / Comments
9.1 Geometry					
9.1.1	The combination of horizontal and vertical alignment approaching Barambah Creek (Bon Accord Bridge) from both east and west severely restricts sight distance, giving motorists little forward awareness of the tight vertical alignment, narrowing cross section and vision to oncoming vehicles. Motorists also cannot identify if water is flowing over the road. It is important that adequate approach sight distance be provided to allow motorists time to recognise the change in road conditions, oncoming vehicles or water over the road, and slow down, react and stop if necessary. Poor sight distance increases the risk of loss of control, run off road and head on crashes at this location.	**Risk Ranking: High** ***Risk Ranking Decision Process:*** *Frequency: Unlikely* *Severity: Serious* *Risk: High.*	**Suggested Actions** - Check stopping sight distance parameters to ensure that sufficient sight distance is available for the following conditions: o To oncoming vehicles crossing the bridge o To floodwater overtopping the roadway at maximum likely flood height. - Improve available visibility by excavating the existing cuttings on the inside of both approaches to the bridge. If sufficient sight distance is not achieved, consider: - Installing reduce speed signs (G9-9). - Installation of VAS "slow down" signage on the western approach. - Undertaking a speed review and implement a regulatory reduced speed limit over the bridge and approaches.	Comments noted, CRC to amend plans to address suggested actions recommended.	Refer to CRC IFC drawings dated 01/07/2024 and relevant Design Notes Report dated 03/07/2024 – the design calculations are detailed within Section 4 Site Distance Criteria and Section 5 Geometry, detailing the available sight distance, horizontal and vertical geometry limitations and mitigations incorporated into the design. The report recommends a speed limit review of the site also, which has since been undertaken and recommended a speed limit of 60km/h, for council's consideration. The use of VAS could be considered should council have compliance issues with speed limits post change. VAS do require regular checks and maintenance (vandalism), reliance on such systems isn't always guaranteed otherwise. Using TMR TN160 as a guide, the site evaluation may not meet the suggested criteria

Clause No.	Audit Findings	Risk Level	Audit Recommendations	Project Manager Accept: Yes or No	Design RPEQ Reasons / Comments
					outlined in section 7 – site assessment. The IFC design drawings also indicate locations where existing cut batter improvements are to be undertaken.
9.1.2	**Horizontal Curve** The civil design drawings show the horizontal curve on the western approach to the bridge has the spiral/ transition extending into the bridge (approx. 30m). However, the bridge design drawings have not adopted the curved alignment for the initial section of the bridge. This will result in a mismatch of the centre of the roadway at the start of the bridge resulting in an angle change. Poor alignment connection from the roadway to the bridge may increase the risk run off road crashes.	**Risk Ranking: High** ***Risk Ranking Decision Process:*** *Frequency: Unlikely* *Severity: Serious* *Risk: High.*	**Suggested Actions** - Review the road alignment to match the bridge abutment coordinates and bridge bearing provided in the bridge design drawing set.	WRD / TRS include edge lines in bridge delineation plan. CRC to include chevron and RPPM as necessary in Bridge Approach Design.	Upon further request for the latest IFC bridge drawings, our review revealed that there have been modifications to the bridge design compared to the last version we received on 13/11/23 - P80 Final Design (Rev 3 – dated 10/11/23). This P80 Final Design was the foundation for our design. We have several observations on the latest Rev 9 drawings, dated 28/05/24: • Changes in both Horizontal and Vertical positions • Modifications to the Crossfall and crown thickness in the DWS • Alterations to the Kerb placement widths • Changes in the Bridge width Proposal is to amend the IFC approach drawings
9.2 Delineation					

Clause No.	Audit Findings	Risk Level	Audit Recommendations	Project Manager Accept: Yes or No	Design RPEQ Reasons / Comments
9.2.1	**Guide Posts** The design drawings do not indicate the installation of guideposts as part of the project. The approaches to the bridge has insufficient guideposts to delineate the edge of the roadway to help guide motorists, especially at night. Poor delineation increases the risk of motorist failing to identify the road geometry and increasing the risk of loss of control, run off road and head on type crashes.	**Risk Ranking: High** ***Risk Ranking Decision Process:*** *Frequency: Unlikely* *Severity: Serious* *Risk: High.*	**Suggested Actions** - Consider the installation of guidepost on the approach curves to the bridge in accordance with AS 1742.2:2022 MUTCD Part 2. - Consider reduced spacing of guideposts due to known fogs in the area. - Consider the installation of RRPM's on linemarking on the bridge to improve nighttime delineation of the roadway.	Comments noted, CRC to amend plans to address suggested actions recommended.	Notation or specification to be included in project documentation. BoQ issued with IFC calls for REGPs. Revised IFC drawing will detail
9.2.2	**Linemarking** The design drawings do not indicate if edge lines are to be painted across the bridge. AS 1742.2:2022 MUTCD Part 2 indicates that edge lines shall be provided for one-way bridges that are greater than 60m in length. The exclusion of linemarking increases the risk of motorists failing to drive in the middle of the bridge, striking the bridge kerbs and motorists thinking it is still a two-way bridge.	**Risk Ranking: High** ***Risk Ranking Decision Process:*** *Frequency: Unlikely* *Severity: Serious* *Risk: High.*	**Suggested Actions** - Consider the installation of edge lines across the bridge in accordance with AS 1742.2:2022 MUTCD Part 2. - Consider the installation of RRPM's on linemarking approaching and on the bridge to improve nighttime delineation of the roadway. - Consider installation of edge lines with 4.0m between edge lines along the bridge in accordance with AS 1742.2:2022 MUTCD Part 2 Figure 4.11. - Consider providing chevron markings to the shoulder areas on the bridge to clearly show that the bridge is one lane only.	WRD / TRS include edge lines in bridge delineation plan. CRC to include chevron and RPPM as necessary in Bridge Approach Design.	This is for consideration bridge design RPEQ. CRC have reinforced the need with the notations for on sheet 6 – for the project signage and linemarking
9.2.3	**Advisory Speed Signage** The road approaches to the bridge have substandard horizontal curves for the posted 100km/h, Wetheron Road. The western approach has an R220m radius curve	**Risk Ranking: High** ***Risk Ranking Decision Process:*** *Frequency: Unlikely*	**Suggested Actions**	CRC to consider advisory speed of 40km/h in support of RSA recommendations.	As detailed within the Design Report provided at IFC, such Vericom assessments would need to be undertaken post construction

Clause No.	Audit Findings	Risk Level	Audit Recommendations	Project Manager Accept: Yes or No	Design RPEQ Reasons / Comments
	while the eastern approach has an approx. R360m curve. The Design Notes provided indicate that the respective design speeds for the horizontal curves are 80km/h for the R220m and 100km/h for the R360m. The design drawings however have incorporated "Turn" W1-1 warning signs with 40km/h advisory speed signs. These horizontal elements are not tight enough to warrant the excessively low advisory speed plates. Regular users of the roadway will learn that the roadway can be driven at higher speeds and create a speed differential to motorist not common with the roadway. This increases the risk of crashes on the bridge approaches.	*Severity: Serious* *Risk: High.*	- Consider carrying out a Vericom assessment of the roadway to determine the correct advisory speed to display. - Consider undertaking a speed review and implement a regulatory reduced speed limit across the bridge and approaches if a lower speed (advisory 40km/h) is required to achieve sight distance capabilities.		and prior to the bridge opening given the current restricted access to the site with roadblocks (soil piles) across the existing roadway. The provided advisory and curve warning signage selection are provided based off the detailed design calculations as outline within the IFC Design Report. It is assumed without a speed limit review (which hasn't been implemented as part of this design) and without provided speed data for the site/s, the approach speed could be in the order of 100km/h+ given the speed limit has a default limit of 100km/h. The design assumed this with an advisory of 40km/h and referring to Table Figure 4.1 of AS1742.2. If an advisory speed of a higher value results from undertaking actions within Clause 4.3.4.2 of AS1742.2, than the curve warning signage type and supplementary advisory should be reviewed. IFC drawings to be updated with ghosted "recommended" advisory speeds and warnings, which are subject to site Vericom assessment post build.

Clause No.	Audit Findings	Risk Level	Audit Recommendations	Project Manager Accept: Yes or No	Design RPEQ Reasons / Comments
9.2.4	**Signage Spacing** The design drawings show existing signage that is to remain and new signage to be installed on the western approach to the bridge. This signage is insufficiently spaced. The "Give Way Ahead" sign has been positioned at the absolute minimum separation to the give way sign. The approach to the give way is on a 10% down grade and will require greater stopping distancep. This increases the risk of motorists being unable to comprehend all signage information and result in overshooting the giveway and crashing head on with oncoming traffic on the single lane bridge.	**Risk Ranking: High** ***Risk Ranking Decision Process:*** *Frequency: Unlikely* *Severity: Serious* *Risk: High.*	**Suggested Actions** - Consider providing sufficient separation between all signage on the approaches to the bridge. - Consider providing a greater separation between the "Give Way Ahead" and "Give Way" signs to provided sufficient time for motorist to comprehend and react on the 10% decline.	Comments noted, CRC to amend plans to address suggested actions recommended.	W3-2 signage was positioned at the absolute minimum required distance. If preferred these can be moved further out and the IFC to be updated to reflect this preference.
9.2.5	**Non-Standard/ Poor Condition Signage** The design drawings indicate that an existing "Bridge Subject to Flooding" warning sign is to remain. The sign referenced is in poor condition (based on Google Street View 2021) and is a non-standard sign, increasing the risk of motorist's confusion and lack of understanding of the upcoming hazard.	**Risk Ranking: Medium** ***Risk Ranking Decision Process:*** *Frequency: Unlikely* *Severity: Moderate* *Risk: Medium.*	**Suggested Actions** - Consider removing the existing sign that is in poor condition and install current standard road subject to flooding signage inclusive of flood depth indicators in accordance with AS 1742.2:2022 MUTCD Part 2.	Comments noted, CRC to amend plans to address suggested actions recommended.	Noted on IFC 01/07/2024 for NBRC consideration. IFC to be updated with revised preference to reflect this comment for signage renewal and MUTCD compliance. .
9.2.6	**Bridge Loading Limit Signage** It is acknowledged that the bridge is designed to meet a T44 loading allowing a loaded semi-trailer to traverse the bridge. Due to the 100m length of the bridge consider impact of multiple semi-trailers traversing the bridge simultaneously. If the bridge design does not allow for this scenario, consider installing load limit signage. Also consider the constraints that the designed bridge loading may have on access for future larger heavy vehicles.	**Risk Ranking: Low** ***Risk Ranking Decision Process:*** *Frequency: Unlikely* *Severity: Insignificant* *Risk: Low.*	**Suggested Actions** - Consider the need to install bridge loading limit signage on the approaches to the bridge.	Comments noted, WRD to review and provide direction.	This is for consideration of the Bridge Designer RPEQ

Clause No.	Audit Findings	Risk Level	Audit Recommendations	Project Manager Accept: Yes or No	Design RPEQ Reasons / Comments
	Excess loadings on the bridge may risk damage to the structure and reduce bridge life.				
9.3 Hazards					
9.3.1	**Kerb** The typical cross sections show proposed new kerbing on the approach to the new bridge. The location shown is positioned in the middle of the road shoulder. The proposed location is not detailed anywhere else within the drawing set. If the new kerbing is to be introduced mid shoulder, there is a risk that motorists could strike the end of the kerb increasing the risk of loss of control crashes.	**Risk Ranking: High** ***Risk Ranking Decision Process:*** *Frequency: Unlikely* *Severity: Serious* *Risk: High.*	**Suggested Actions** - Consider updating plans to detail full kerb setout. - Consider introducing kerbing at the edge of the sealed formation and transitioning down to the bridge kerb width.	Comments noted, CRC to amend plans to address suggested actions recommended.	To be included in an updated IFC drawings due to bridge positioning of bridge detailed design IFC altering.
9.3.2	**Bad Weather** It was brought to the auditor's attention that the Bon Accord bridge site experiences fogs at times impacting on motorists' visibility. The lower visibility conditions could result in poor decision making by motorists entering onto the one lane bridge especially if motorists do not have their headlights on.	**Risk Ranking: High** ***Risk Ranking Decision Process:*** *Frequency: Unlikely* *Severity: Serious* *Risk: High*	**Suggested Actions** - Consider the need to install Warning Sign "Heavy Fog Headlights on for Safety" TC1733 on the approaches to the bridge.		
9.4 Constructability					
9.4.1	**Deck Wearing Surface** The design proposes to transition and feather out the new bridge deck wearing surface to the approach concrete slabs. Deck wearing surfaces need to be laid to a minimum thickness and cannot be feathered out to a zero thickness. If placed as shown within the design	**Risk Ranking: High** ***Risk Ranking Decision Process:*** *Frequency: Unlikely* *Severity: Serious* *Risk: High.*	**Suggested Actions** - Consider keying the deck wearing surface into the concrete approaches, or - Consider amending the road grading on the approaches to the concrete slabs to allow for a	Comments noted, CRC to amend plans to address suggested actions recommended. Note; the approaches to match bridge DWS levels, therefore avoiding feathering of AC.	Preference was for the new approach and relieving slab to match to DWS, but construction sequencing proposed at the time (bridge in after) restricts ability to match well. It is understood that

Clause No.	Audit Findings	Risk Level	Audit Recommendations	Project Manager Accept: Yes or No	Design RPEQ Reasons / Comments
	drawings, there is a risk that the wearing surface could delaminate from the concrete approaches during flood events resulting in a rough road surface, increasing the risk of loss of control crashes.		minimum thickness wearing surface layer to be applied over the concrete approaches to the bridge, or - Consider constructing the approach concrete slabs flush to the new bridge relieving slab profile with minimum depth deck wearing surface.		there has since been further modification to the bridge positioning due to the existing abutment ledge height and now concrete relieving slab can match DWS. IFC to be updated to reflect
9.4.2	**Cross Section Profile at Start of Project** The design cross sections show that the new design profile does not match the existing road shape at the start of the project. If the new construction matches the design plans there will be a rough connection to the existing roadway at the start of the project that increases the risk of loss of control crashes.	**Risk Ranking: High** ***Risk Ranking Decision Process:*** *Frequency: Unlikely* *Severity: Serious* *Risk: High.*	**Suggested Actions** - Ensure that smooth connections are provided between existing and new work. - Ensure that design standards are adhered to for rotations of road crossfall to match at tie in locations.	Comments noted, CRC to amend plans to address suggested actions recommended.	To be amended in revised IFC

Sign Off, (Design RPEQ) …… Acceptance, (Project Manager) ……

Name…… Date…… Name: …… Date ……