SOUTH-EAST SCANNING

GPR Survey Report

Client: RoadTek Mackay (TMR)

Location: Marion Creek Bridge QLD

QR code
Scan here to visit our website.

SOUTH-EAST SCANNING PTY LTD
www.southeastscanning.com.au

Contents

Marion Creek Bridge

Evaluation of asphalt cover depths and GPR data assessment.

Marion Creek Bridge Assessment.

Technician: Aidan Waszaj

Date: Monday 23rd of February

GPR unit: Proceq GP8000

Executive summary

This report presents the results of a ground-penetrating radar assessment conducted at Marion Creek Bridge, Ilbilbie, for RoadTek Mackay. The survey was undertaken using a Proceq GP8000 GPR system to assess relative asphalt thickness across the bridge deck.

Due to the short overall bridge length comprising four spans, two longitudinal scan lines were assessed within each span to provide improved spatial representation of asphalt thickness variability.

The asphalt wearing surface at Marion Creek Bridge was found to be comparatively thin and variable. Measured thicknesses generally range between approximately 30 mm and 45 mm across much of the deck, with localised thinner zones recorded between approximately 23 mm and 25 mm. Isolated thicker areas approaching 47–49 mm were also observed.

Unlike Alligator Creek Bridge, where asphalt thickness was generally consistent, Marion Creek Bridge exhibited significant intra-span variability. Thickness fluctuations were noticeable even within individual spans and became particularly evident approaching the relieving slab. This variation does not present as a systematic progressive thinning trend across the structure but instead reflects localised construction variability and surface condition.

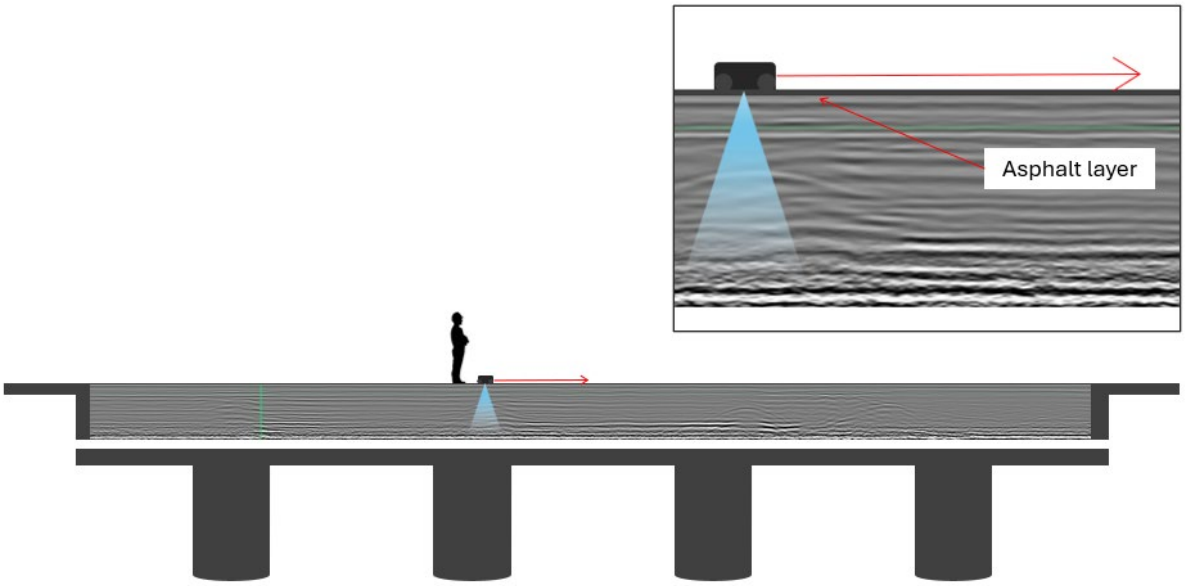
Site conditions influenced the quality and consistency of the GPR signal response. The asphalt surface was heavily weathered, with exposed deck areas present in sections. Extensive cracking, previous rainfall, and moisture retained within surface defects contributed to variable dielectric behaviour across the deck. A dielectric constant of 6.5 was adopted as a representative average for this aged and heat-exposed asphalt surface in Mackay's climatic conditions.

In several areas, the asphalt–concrete interface was not consistently distinguishable in B-scan data and required confirmation through detailed A-scan waveform analysis. Even with waveform interpretation, moisture pockets and surface cracking occasionally produced early signal responses between the surface reflection and the true interface, further complicating interpretation.

While reinforcement depth correlation supports the general validity of the adopted velocity model, the results at Marion Creek Bridge should be considered a representative snapshot of relative asphalt thickness rather than a uniformly consistent overlay profile. The magnitude of variation observed across the deck exceeds typical minor paving tolerances and likely reflects historical resurfacing practices, patching, variable compaction, or differential wear.

Overall, the bridge wearing surface may be characterised as thin and variable, with localised areas approaching minimal overlay thickness. The results are suitable for maintenance planning and resurfacing assessment purposes.

Explanatory notes: GPR for bridge deck scanning.



How GPR can be used to determine asphalt thickness

Ground-penetrating radar (GPR) is a powerful tool for assessing bridge surfaces, particularly for determining asphalt thickness on a bridge deck. GPR works by sending electromagnetic waves into the surface and measuring the reflections from different materials beneath it. These reflections are displayed as 2D data, representing a cross-sectional view of the scanned area.

In GPR data, certain features appear as hyperbolas, indicating objects such as reinforcement bars (rebar) embedded in the bridge deck. These hyperbolic shapes result from how radar waves scatter when encountering these dense, metallic objects. Identifying these helps pinpoint the location and depth of structural components.

GPR also distinguishes layers within the structure. The asphalt and bridge deck layers have different densities and material properties, resulting in distinct reflections in the radar data. In the 2D data, the asphalt appears as a thin, uniform layer near the surface, while the bridge deck shows a denser, thicker boundary beneath it. Analysing the separation between these layers allows accurate measurement of asphalt thickness.

While GPR offers several benefits, such as being non-invasive, rapid, and capable of providing continuous data over large areas, it also has limitations. Surface conditions, material inconsistencies, or moisture can sometimes influence the results. GPR alone cannot provide material properties or conclusively determine thicknesses. For accurate calibration and validation, pairing GPR results with destructive testing methods, such as core sampling, which physically verifies the material layers and depths, is essential.

Stakeholders should understand that while GPR provides a highly efficient method for preliminary assessment and identifying areas of concern, it is part of a broader toolkit. Combining it with other testing methods ensures a comprehensive understanding of the bridge surface condition and structural integrity.

Assessment Overview

GPR longitudinal scans were undertaken across each of the four bridge spans to estimate the thickness of the asphalt wearing surface. Due to the relatively short overall bridge length, two longitudinal scan lines were assessed within each span to provide improved spatial representation of intra-span variability. The interpreted thicknesses are presented on the accompanying map and represent averaged values derived from these longitudinal assessments.

The data indicate that asphalt thickness varies both between spans and within individual spans. Across the surveyed bridge, typical asphalt thicknesses range from approximately 30 mm to 45 mm, with localised thinner zones between approximately 23 mm and 25 mm and isolated thicker areas approaching 47 to 49 mm. Variability within individual spans was more pronounced than observed at Alligator Creek Bridge, particularly in areas approaching the relieving slab. This variation reflects localised construction and resurfacing variability rather than a uniform overlay profile.

Asphalt thickness estimation using GPR relies on identifying the dielectric contrast between the asphalt layer and the underlying concrete deck. At Marion Creek Bridge, the interface was not consistently distinguishable in B-scan data and required confirmation using detailed A-scan waveform analysis. The reflected waveform contains both positive and negative oscillations, and careful selection of the appropriate wavelet phase is required to avoid misinterpretation. Minor shifts in picking position, whether selecting the first break, peak amplitude, or zero crossing, can result in small differences in calculated thickness.

Velocity calibration was performed using hyperbola matching on the reinforcement layer to maintain internal depth consistency. However, site conditions introduced additional interpretative complexity. The asphalt surface was heavily weathered, with exposed deck sections; extensive cracking was observed, and recent rainfall resulted in localised moisture pockets. These factors produced variable dielectric behaviour across the deck, occasionally generating early signal responses between the surface reflection and the true asphalt concrete interface. A representative dielectric constant of 6.5 was adopted to reflect the aged and heat-exposed asphalt conditions. Accordingly, the values presented should be understood as representative estimates of relative asphalt thickness rather than absolute millimetre-precise measurements. The magnitude of variation observed across the bridge is considered indicative of historical resurfacing, patching, variable compaction, and differential wear, rather than systematic structural deterioration.

Methodology and Calibration

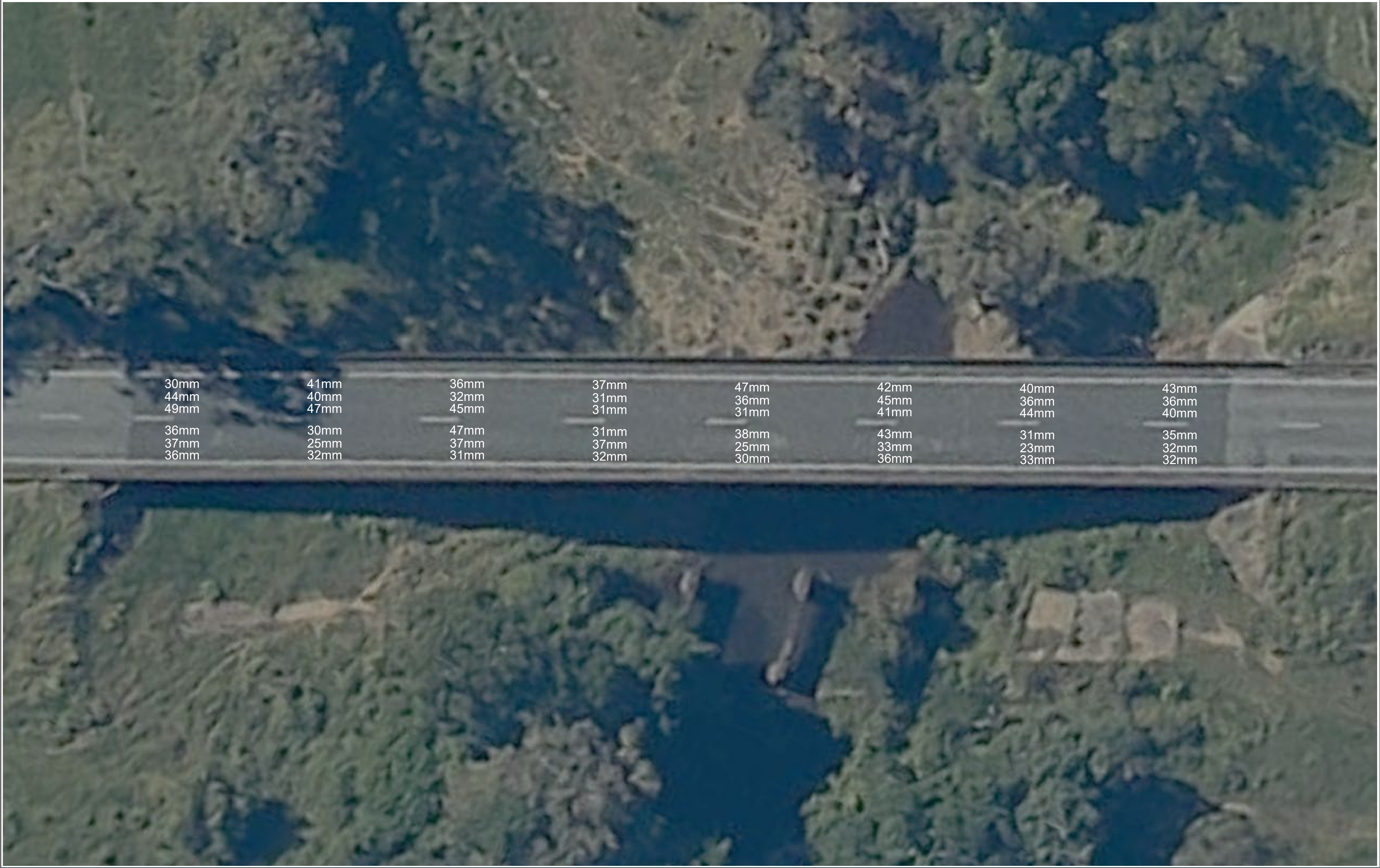
Ground-penetrating radar transmits electromagnetic waves into the structure and records reflections from changes in material dielectric properties. The contrast between asphalt and the underlying concrete produces a reflection that can be interpreted to estimate layer thickness.

Calibration was performed using hyperbola fitting on reinforcement reflections beneath the asphalt layer to ensure depth consistency. When signal clarity was reduced by cracking or moisture, a detailed A-scan waveform analysis was used to confirm the interpreted interface. Bridge span locations were identified in the dataset and used to select representative longitudinal assessment points.

Interpretation Notes and Limitations

The accuracy of GPR-derived depth estimates can be influenced by factors such as moisture content, material heterogeneity, surface condition, and signal attenuation. In some locations, horizontal horizons associated with asphalt and concrete interfaces were clearly defined, whereas in other areas they were more difficult to resolve.

GPR should therefore be considered a diagnostic and screening tool. All depth measurements presented in this report are subject to an estimated tolerance of plus or minus 10 per cent. When precise thickness values are required for design, maintenance, or compliance, physical verification, such as coring or test pits, is recommended.



Executive Summary

GPR assessment indicates a thin and variable asphalt wearing surface across Marion Creek Bridge. Thickness generally ranges between approximately 30 mm and 45 mm, with localised areas as low as 23–25 mm and isolated thicker sections approaching 47–49 mm. Significant intra-span variability was observed. Values represent representative estimates derived from waveform interpretation and are suitable for maintenance planning purposes.

SOUTH EAST SCANNING

Geolitix link: N/A

Reflection Amplitude

Weak — Strong

www.southeastscanning.com.au

PROJECT:	Marion Creek Bridge GPR Report
CLIENT:	RoadTek Mackay
ADDRESS:	79R5+8X Ilbilbie, Queensland
TECHNICIAN:	Aidan Waszaj
DATE(S):	23/02/26
DRAWING:	1/1

Figure 1: Location of the bridge. This data was captured from Queensland Globe

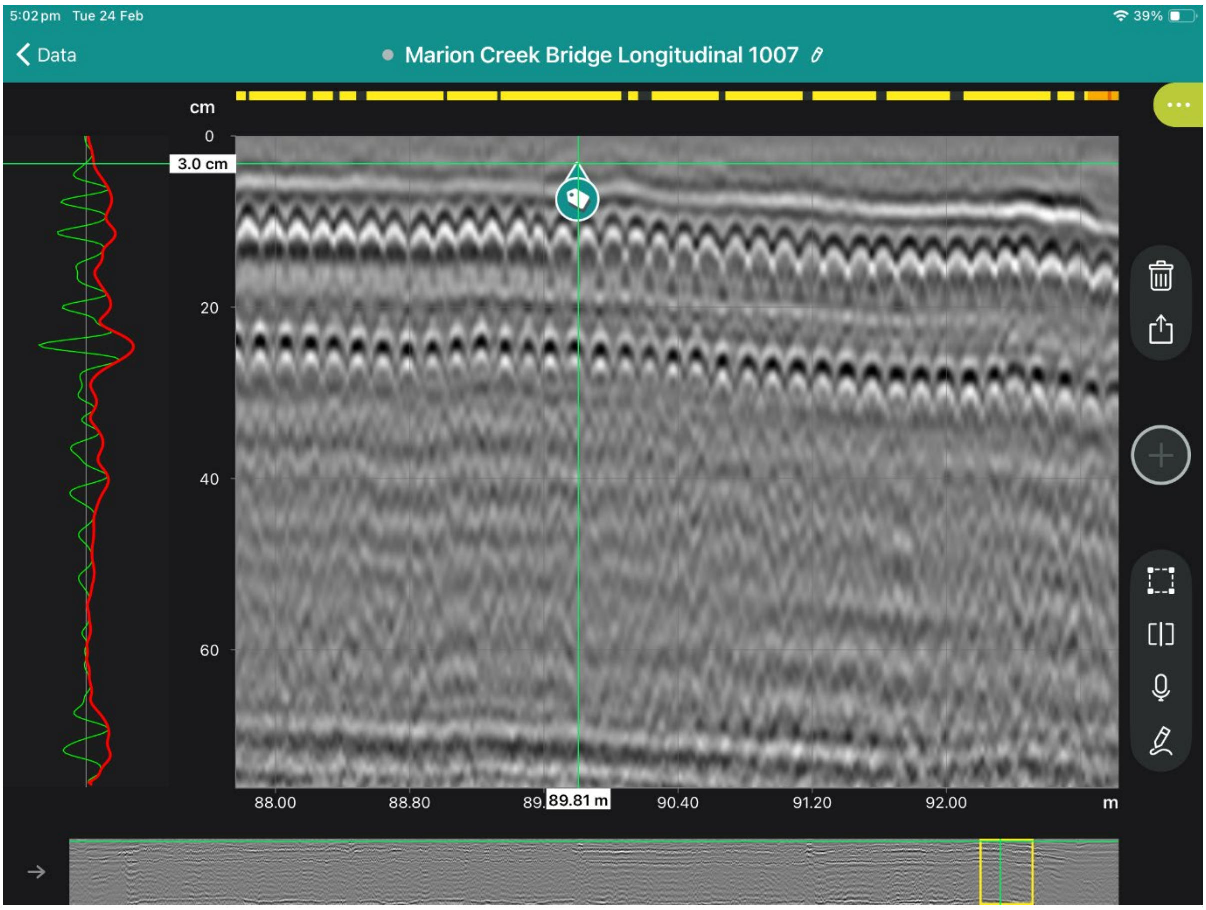


Figure 2: Longitudinal GPR profile illustrating a thinner asphalt section, with the asphalt–concrete interface interpreted at approximately 30 mm depth. The interface is less clearly defined on the B scan, requiring confirmation through detailed A-scan wiggle-trace analysis. The green waveform identifies the correct phase of the reflected signal, while the red envelope highlights reflection strength. The A-scan confirms a shallow wearing surface at this location, consistent with the localised thinning observed across the bridge.

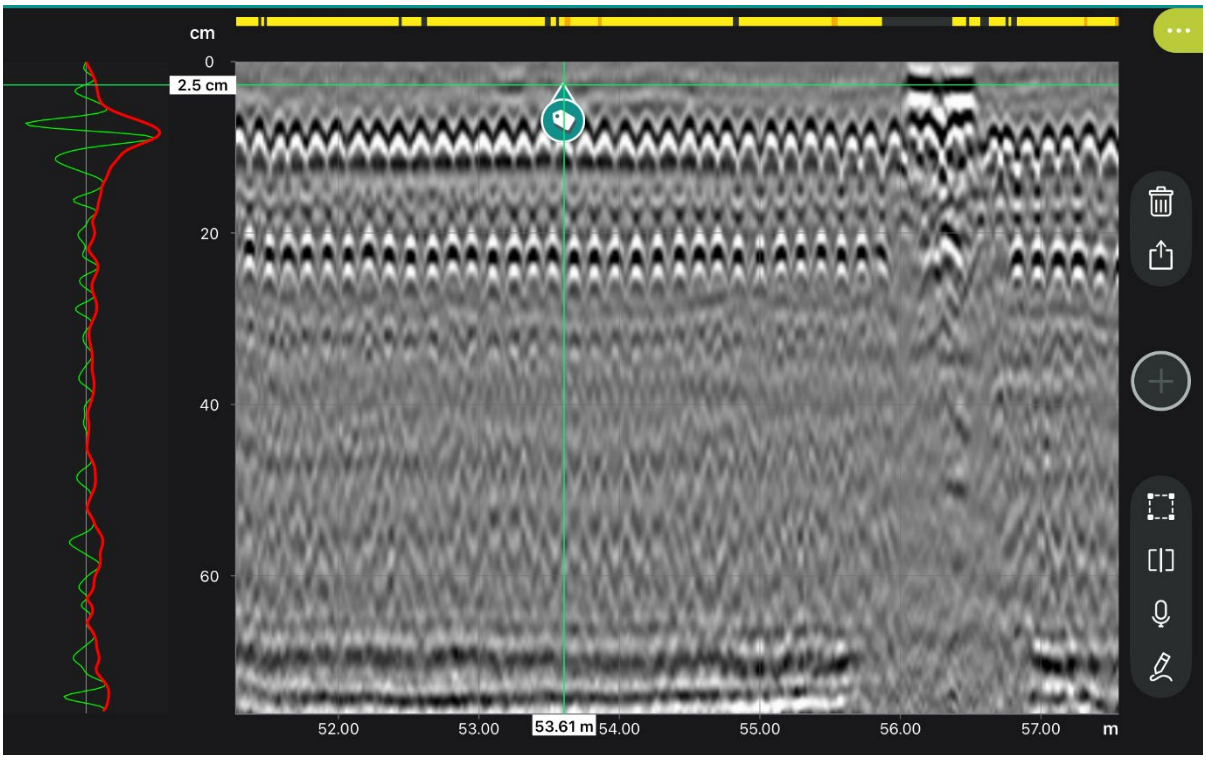


Figure 3: Longitudinal GPR profile showing an asphalt thickness of approximately 25 mm. The interface is subtle in the B scan due to surface cracking and dielectric variability; however, A scan waveform interpretation confirms the correct reflection phase corresponding to the asphalt–concrete boundary. This example demonstrates one of the thinner zones identified during the survey and highlights the importance of waveform phase selection in shallow layer assessment.

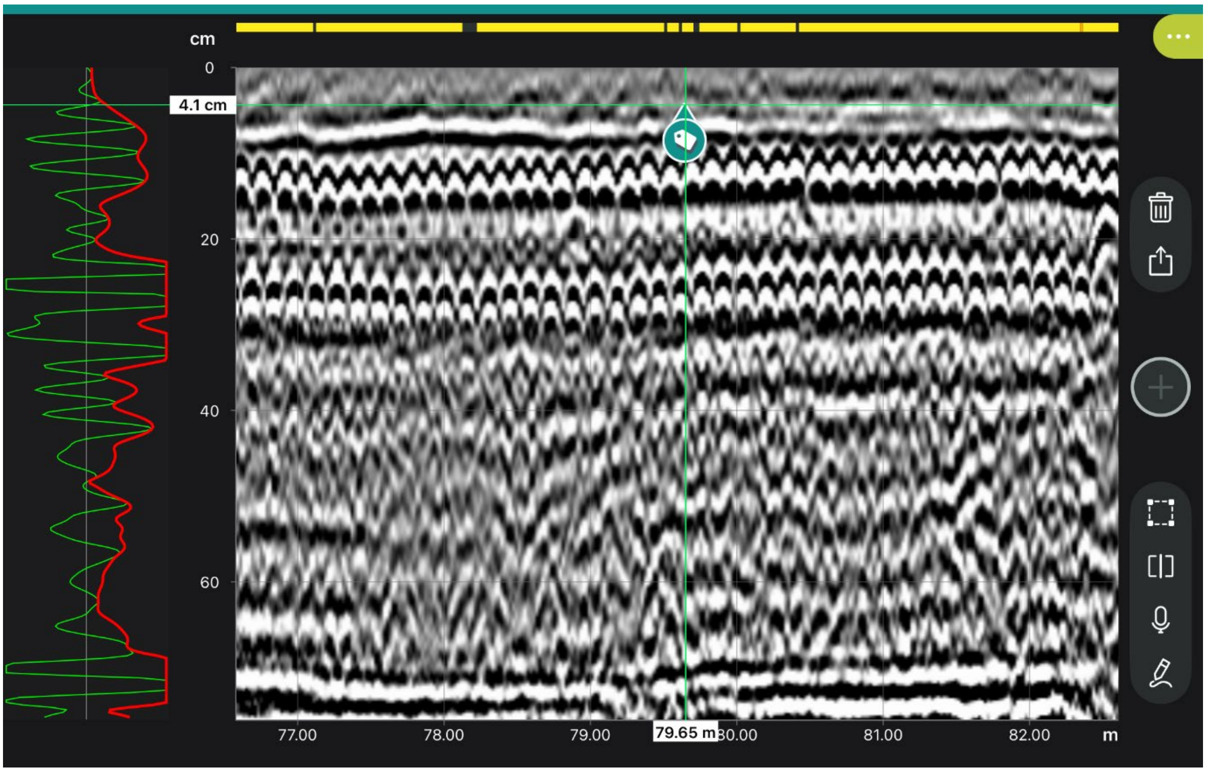


Figure 4: Longitudinal GPR profile demonstrating a comparatively thicker asphalt section, with the interface interpreted at approximately 41 mm depth. The reflection is more clearly distinguishable in both the B scan and the corresponding A scan. The wiggle trace confirms a deeper asphalt–concrete boundary relative to Figures 2 and 3, providing a clear contrast between thinner and thicker overlay areas within the same structure.

Conclusion

The GPR assessment of the Marion Creek Bridge indicates a relatively thin, variable asphalt wearing surface across the four surveyed spans. Thicknesses generally fall within the 30 mm to 45 mm range, with localised areas of reduced thickness identified.

Variability observed within individual spans reflects historical resurfacing practices, patching, and differential wear rather than a consistent overlay profile. Site conditions, including surface cracking and moisture retention, introduced additional interpretative complexity; however, reinforcement correlation supports overall depth consistency.

The reported thickness values represent reasonable estimates of relative asphalt depth and are suitable for maintenance planning and resurfacing assessment.