

7<sup>th</sup> September 2021

Letter No. 1.21.22198.1 Project No. 1.21.22198

Shire of Serpentine Jarrahdale 6 Paterson St Mundijong WA 6123

Attention: Prad Maha

Dear Prad

## RE: Structural Assessment of the Collapsed Steel Helical Culverts Corner of Wellard Street and Karnup Road Serpentine

## INTRODUCTION

At the request of Prad Maha of the Shire of Serpentine Jarrahdale, the purpose of the structural inspection and this report is to:

- Inspect, assess and document the current state of two steel helical culverts running under Karnup Road, at the corner of Wellard Street, as of 6/9/2021.
- Provide recommendations on the type and timing of temporary traffic safety measures.
- Provide recommendations on the type and timing of appropriate repairs.

The on-site assessment was limited to a visual only inspection of the culverts.

## ASSESSMENT SUMMARY

- It is assessed that the steel culverts have failed due to loss of steel section from corrosion.
- The age of the culverts is unknown.
- At the northern end:
  - o the culverts have collapsed and are at risk of imminent failure,
  - o the culvert section shapes are deformed by dipping at the top,
  - o at the culvert entries the inverts have completely corroded through,
  - along much of the length the inverts have almost completely corroded through,
  - o perforations in the culverts have allowed fill to fall into the culverts,
  - o joints between helical segments have become misaligned,
  - the road surface has subsided.
- At the southern end:
  - the culverts have not yet collapsed,
  - o the culvert sections have retained their shape,
  - o at the culvert outlets the inverts have completely corroded through,
  - o along the length the inverts have almost completely corroded through,
  - there are no obvious signs of subsidence in the road surface, although Shire representatives suggested there has been some minor subsidence.

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- Structural features of the culverts are:
  - 1.5m overall diameter (approximate),
  - 1.1m of fill above,
  - 130x30mm approximate helical pitch,
  - 1.6mm steel thickness.

A series of photos are included in Appendix B.

Figure 1 shows the general arrangement of the road and culverts.

## TYPE AND TIMING OF ROAD SAFETY MEASURES

As advised on site, 6/9/21:

Recommended critical and immediate measures are:

- The northern lane is to be closed to all traffic until such time as the culvert is replaced.
- All heavy traffic is to be diverted away until such time as the culvert is replaced.
- Bridge across the southern lane with precast planks as shown in Figure 3. Precast planks are to be Deltacore DC150 planks with 5 No. 9.3mm diameter bottom strands (or approved equivalent), laid onto bedding sand to ensure even bearing. Extend planks 1.5 metres beyond each end of the culvert.
- If bridging the culverts with precast planks is delayed due to availability of precast products, the culverts under the southern lane are to be propped as shown in Figure 4 until such time as the bridging slabs can be installed (e.g. maximum one month). It will not be possible to prop approximately 3.5 metres from the outlet as the base of the culverts have been completely corroded through.
- Traffic hazard signage and speed reduction is to be put in place, ensuring adequate stopping sight distance should a hazard develop.

Recommended ongoing measures are:

- Subject to speed reduction, hazard signage and the installation of bridging slabs or props, restrict the southern land to light Class C or lighter vehicles only (not more than 4.5T gross).
- Monitor the left lane weekly for subsidence. Monitor also after short duration rain events.
- Close the entire road if heavy or extended rains are forecast or experienced, as scouring may compromise the culvert and propping. Open the road again only following engineering assessment and advice to do so.

Figure 2 shows the general arrangement of the traffic safety measures.

## TYPE AND TIMING OF APPROPRIATE REPAIRS

As soon as practicable and within six months, replace the culverts.

Due to the permanence of standing water in the culvert, it is recommended that the culverts be replaced with concrete structures.

Trenchless technologies such as pipe jacking may be considered around the existing culverts for the same reason and allow for replacement without closing the road.

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## PROPPING

Propping of the culverts is aimed to provide immediate stabilisation of the structures. However, propping can only slow the complete collapse and there is still future risk to the public should a failure occur, hence the requirement for a bridging slab.

Propping is only possible under the southern lane, up to the location of misalignment of joints (shown in Appendix B, photograph 5). Under the northern lane the culvert has collapsed.

To ensure safety during installation, propping should only occur when the road is entirely closed and during periods of low stream flow.

Propping should be installed in a south to north direction, so that the structure is progressively propped as you enter deeper into the culvert.

Due to the extent of corrosion at the base, propping is to be installed at 45 degrees.

Pairs of Acrow No 0 props are required at 800mm centres as shown in Figure 3.

Timber sleepers are to be provided at each end, with minimum two props per sleeper. Props are to be connected to the sleepers with screws each end.

## CLOSING

If this Office can assist further in the future, such as for reassessment of the state of the culverts over time, or if clarification is required on any observations detailed here, please do not hesitate to contact the undersigned.

Yours faithfully

Andrew Sanderson Lead Structural Engineer, Associate M: 0458 736 665 E: asanderson@structerre.com.au

#### **Disclaimer:**

This report is at the request of the addressee and no liability is accepted by Structerre Consulting Engineers to any third person reading or relying upon the report, notwithstanding any rule of law and/or equity to the contrary and that this report is strictly confidential and intended to be read and relied upon only be the addressee.

**Enclosure:** Appendix A – figures Appendix B – site photographs

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## **APPENDIX A**



Figure 1: General arrangement of road and culverts



Figure 2: General arrangement of road safety measures

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Figure 3: Bridging slab



Figure 4: Propping arrangement example





# **APPENDIX B**



Photograph 1: General arrangement of the culverts from the northern end



Photograph 2: Corrosion loss of section at the invert from the southern end

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Photograph 3: Debris inside culvert northern end



Photograph 4: Inside culvert from the northern end showing the collapsed section

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Photograph 5: Separation and failure of the joint from the southern end



Photograph 6: Historical photo (provided by the Shire) showing subsidence of the northern end road surface

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