

# Report on CSRA Sarawia Street Underpass Proposal

## Newmarket Level Crossing Project

2nd September 2014

### Purpose

Auckland Transport (AT) analysis of the underpass proposal prepared by the Cowie Street Residents Association (CSRA).

### Background

The option of an underpass linking Sarawia Street to Laxon Terrace has been considered as far back as 2004 by Auckland City Council as part of a wider grade separation study. As part of AT's Newmarket Crossing Project options analysis, the option of an underpass was re-evaluated and considered at a high level and again considered an unsuitable option to progress.

In June 2013 representatives from the Parnell Community Committee (PCC) and Cowie Street residents approached AT with a proposal for an alternative underpass alignment prepared for them by Maurice Harris of Harris Foster Consulting Group (HFC). The underpass was proposed as an alternative option to allow closure of the Sarawia Street crossing while retaining vehicle access to Laxon Terrace and Youngs Lane. It was suggested by the PCC and Cowie Street residents that this would be more acceptable to residents.

AT investigated the underpass option further, soliciting advice and investigative work from Opus, Hawkins, Xigo and Fraser Geologics, with cost estimates prepared by Cuesko. The outcome of this investigation was that variants of the alignment proposed by the PCC were feasible to construct. The construction risks, extent of rail disruption requirement, Crime Prevention Through Environmental Design (CPTED) issues, traffic safety challenges and cost associated with the underpass option concluded that the underpass was an inferior option compared to other options considered. The AT project team met with the PCC and Cowie Street representatives to discuss the option and results of AT's analysis.

Following the conclusion of the project Scheme Assessment Report (SAR) and the AT Board decision to progress the over bridge option from Cowie Street to Laxon Terrace, the Cowie Street Residents Association (CSRA) commissioned a further investigation into the feasibility of an underpass. This report was presented to the Waitemata Local Board in early May 2014 and the Local Board requested AT to re-evaluate the underpass option in light of this report.

AT assessed the latest report against the previous underpass investigation in 2013 to identify any points of difference and to what extent the new information addressed the challenges associated with the underpass option.

Subsequently, CSRA presented a revised August 2014 report to the Waitemata Local Board and AT on 12th August.

Both the April and August 2014 CSRA reports can be found in Appendices 2 and 3.

### Engagement with CSRA

AT met with CSRA representatives and their consultants on 5th June 2014 to discuss the report and AT's initial analysis of the report. The principal challenges for any underpass



proposal in this location were identified in AT's SAR analysis, and it was communicated to CSRA and their consultants that having reviewed their April 2014 report, these challenges remain insufficiently addressed to significantly alter the outcome of the SAR. The SAR assessed each feasible option comparatively to determine the best overall option to progress. The principal challenges associated with an underpass at that location are:

- High levels of risk and rail disruption associated with the construction, with likely adverse consequences to both cost and programme;
- Most challenging CPTED concerns when compared to alternative options;
- Significant traffic safety challenges when compared to alternative options; and
- A low benefit-cost ratio when compared to alternative options.

CSRA and their consultants maintained at the meeting that they had further ideas and innovations not disclosed in their April 2014 report which would show how these obstacles could be overcome. AT's position was that there was no substantiation of these claims within the report, but that AT would be willing to discuss the CSRA ideas further.

As an outcome of this meeting, it was agreed that separate meetings between the respective specialists be arranged:

- *Constructability and underpass design*: Harris Foster Consulting Group (HFC) for CSRA and Opus for AT
- *Traffic Safety*: Parlane and Associates for CSRA and Traffic Planning Consultants (TPC) for AT
- *CPTED*: Harrison Grierson for CSRA and Scope Investigations for AT.

In addition, AT was to discuss with KiwiRail a point of liaison for information on the live overhead wire placement and constructability impact for both parties.

Following the meeting, Mark Goodman, KiwiRail Traction Service Manager, was put forward by KiwiRail as liaison point to discuss the live overhead. Geotechnical information was provided to HFC by Fraser Geologics at AT's request on 25th July.

Two meetings were held between HFC and Opus on underpass design and constructability (20th June and 8th August), and Maurice Harris of HFC independently met with AECOM, KiwiRail's overhead line designers. A meeting was held between Parlane and Associates and TPC on 19th June.

No meeting to discuss the CPTED aspects of an underpass was held, as AT was unable to obtain CSRA agreement to a meeting between the respective consultants.

AT and CSRA were in contact periodically, with several attempts to agree a final deadline to receive any further substantiating information from CSRA to support their report's assertions. This date was understood to be agreed as 1 August, following HFC's receipt of geotechnical information from Fraser Geologics.

No further information was received from CSRA or their consultants by this date and AT advised CSRA and HFC that AT would be progressing with an assessment of their proposal on information received, and that any further information needed to be supplied urgently if it was to be included in this analysis.

A further meeting between HFC and Opus was agreed, held on 8th August, where HFC tabled further underpass design drawings. On 12th August CSRA presented an updated report to the Waitemata Local Board and a copy of this report was provided to AT and included in this analysis. Maurice Harris (HFC) met with AT on 27th August to discuss the updated report.

The CSRA August 2014 report includes statements that are incorrect, including:

- *That requested overhead line information was withheld from CSRA by AT (p.1):* The overhead line information is held by KiwiRail, and was supplied to both AT and HFC on 18th July. AT received this information at the same time as CSRA's consultants HFC, and nothing was withheld.
- *That geotechnical information was not supplied (p.2):* Fraser Geologics supplied this information to HFC on 25th July. The deadline of 1st August was agreed with HFC following their receipt of this information.

## Analysis

The AT and Opus analyses are based on information received to date from the CSRA, which includes the April 2014 report and the subsequent August 2014 report.

The positives identified by CSRA for their underpass option are largely in agreement with AT: that it retains the current direction of traffic flows, and that it does not involve any private land acquisition other than KiwiRail land. However, the April 2014 CSRA report adds that the underpass option is superior to a Cowie Street bridge both in terms of cost and CPTED principles, both assertions AT do not agree with. This CPTED assertion is removed from the August 2014 report, which refers only to CPTED mitigations possible to improve an underpass with no comparison against the other feasible access options.

The CSRA and report contributors do appear to be familiar with AT's investigation into an underpass option and have generally identified AT's concerns about the underpass. Taking each of these in turn:

- **Cost:** The CSRA report cost estimate is significantly lower than the Cuesko estimate prepared for AT. The main areas of difference are identified in the Opus report in Appendix 5. Significant points of difference are the CSRA lower cost for the rail bridge structure and beams, and absence of any piling and abutment costs in their estimate.

The August 2014 report revises the cost estimate upward from \$5.0M to \$5.6M, still substantially lower than AT's estimate for the lowest-cost underpass alignment of \$8.2M. Although HFC state in the August 2014 report that their concept design 'includes the recommendations and feedback from the above [KiwiRail engineers, CPTED, traffic and constructability] advisors', the CPTED recommendations in their report do not appear to have been addressed in either design or cost estimate. As described in the Opus report in Appendix 6, widening of the underpass entrances and footpath and chamfering of the approach will add to their cost estimate, as will including access road connections for KiwiRail.

Similarly, costs associated with relocation of in-ground services, notified resource consent and property costs with KiwiRail are excluded, and the estimate assumes unrestricted access during normal working hours (highly unlikely due to rail services and construction will require night and block of line works at critical points) and excludes unknown ground conditions, a high risk to constructability.

Based on the AT and Opus analysis and supported by Cuesko's cost estimate for the AT 2013 SAR analysis, the CSRA underpass alignment should be expected to cost significantly more than the AT estimate of \$8.2M for the lowest-cost alignment option.

- **Technical, construction complexities and geotechnical risks:** The April 2014 CSRA report states that there are no technical constraints for a suitable underpass, a 'smart solution can be implemented to minimise [rail] closure, and that geotechnical

risks are always present and are 'reasonably predictable'. Although this statement is removed from the August 2014 report, the geotechnical information supplied to HFC on 25<sup>th</sup> July appears to be largely excluded from the report's assumptions.

Geotechnical risk is a significant concern for AT: the land where the underpass would be constructed is composed of poorly-compacted sandstone material relocated from Parnell tunnel and requiring deep piling. While detailed geotechnical investigation will help understand and mitigate this risk, it remains a known and serious constraint to construction at the underpass location. From AT's meeting with Maurice Harris on 27th August, while some consideration of the site ground conditions has been made, they would appear to be optimistic given the level of uncertainty involved.

Following the initial meeting on 5th June, HFC have spent considerably more time investigating the constructability issues. The CSRA August 2014 report includes high-level staging drawings and constructability commentary from Lifting Management Ltd based on their experience replacing KiwiRail's Bridge 3 MSL damaged in the Christchurch earthquakes. Opus' report in Appendix 6 includes detail on the continuing challenges around constructability of an underpass not addressed by the CSRA reports and concludes that there is no direct comparison between Bridge 3 MSL and an underpass/rail bridge at Sarawia Street.

Bridge 3 MSL was a replacement of an existing twin track road underpass on level ground with open access and far less frequent rail traffic. It is not an electrified part of the rail network, with no electrified overhead line system to work around. The Bridge 3 MSL works involved replacing existing steel spans on brick abutments with sheetpile abutments, precast caps and two concrete ballast deck spans. Significant points of difference include:

- Bridge 3 MSL was the replacement of an existing structure, hence lesser earthworks required and no new road to construct.
- The completed Bridge 3 MSL required no KiwiRail access requirements to accommodate other than steel footpaths either side of the track.
- Bridge 3 MSL was in an easily accessible part of the road network that provided alternative access during the works.
- The ease of site access allowed multiple cranes to be used with no significant impact on the local road network.
- The Bridge 3 MSL location was not in a close, community-based area and therefore restrictions on noise and hours of work were less stringent.

In their review of the proposal, Lifting Management Ltd state, 'installing piles could not be accomplished without major disruption to rail operations and, in any event, would be difficult, if not impossible, due to the limited area available for the large piling equipment and the presence of the overhead electric power lines.' The August 2014 CSRA report removes much of the piling work AT considers necessary in order to deal with the ground conditions at the site, but still retains sheetpiles at four locations, estimated by Opus to require a depth of 12m (Appendix 6). Given this activity is shown by HFC drawing G106 as requiring no power shutdown or block of line, it is not clear how this activity interacts with Lifting Management's comments about the difficulty of placing piles without disruption to rail services.

Bridge 3 MSL Photos of the bridge are included in Appendix 8 which illustrate the lower construction constraints involved in the works there compared to construction at Sarawia Street, noting that Sarawia Street crossing is overwhelmingly the busiest level crossing in New Zealand in terms of rail movements, and the most complex.

KiwiRail have advised that the Bridge 3 MSL works took place over approximately 3 x 36 hour blocks of line (108 hours shutdown total, or 13.5 eight hour shifts), excluding the piling and sheetpiling works which could not have been accomplished in an electrified network such as Auckland without disruptive measures such as a block of line. This is certainly not consistent with the HFC statement that a 'small [rail] closure will be required but this will be limited to days not weeks.'

AT's position is that the construction of an underpass would require piling due to the ground conditions, and would need to be undertaken over a 3-4 week rail block of line, with risk that the complexity of the construction causes programme overrun and delays to restoration of services.

Although 4 week Christmas shutdowns have been approved in the past to facilitate the Auckland Electrification Project (AEP), it is understood that these will not be available in future and a 2 week shutdown is likely the longest possible to be obtained.

Additionally, the excavation adjacent to the track prior to any block of line would require continued track monitoring to check for movement. This is a critical activity, and if problems are detected, could stop works from continuing. This has not been addressed in the CSRA report.

The presence of 25kV overhead wires is not mentioned in the April 2014 CSRA report, but is addressed in the August version. Two traction masts are identified by HFC as requiring relocation, involving an element of overhead equipment redesign and repositioning of traction masts and wire. While feasible, this adds potential delay and disruption should there be any difficulties in re-commissioning the overhead.

Conversely, a Cowie Street bridge avoids most of these challenges, and can be built largely outside of a block of line, with only the lifting in of the bridge span requiring a weekend or long weekend block of line. The overhead line can be deconflicted from the bridge location, removing the need to relocate traction masts. During construction there will be significantly less restriction on access to Sarawia Street from Laxon Terrace as the construction site is for the most part away from roads. Similarly, site access and craneage is more manageable.

- **Gradient:** The CSRA April 2014 report argues that the grade is not steeper than the rest of Sarawia Street and AT would agree with this. However, when comparing the merits of one option against another, the Cowie Street bridge option allows the opportunity to improve gradients so that they are compliant to AT's standards for road and disabled access.

The option recommended by the CSRA most closely resembles Option 3 of Opus' investigation into an underpass alignment. This was ruled out in favour of options crossing under the rail further south due to the gradient issues involved. In order for the road level to get low enough to provide the necessary 4.5m of vertical underpass clearance the grade will have negative safety implications and would be difficult for a person in a wheelchair to safely navigate.

- **KiwiRail access to the Newmarket triangle:** KiwiRail service roads run alongside the track at both sides of the rail corridor and would need to be maintained. Retaining access to the southern road would remain relatively unaffected, although does limit or remove options to narrow the underpass width to aid CPTED compliance as recommended by CSRA's consultants Harrison Grierson. Retaining access to the northern road will require building an access road up from the lowest point of the northern underpass exit to track level. While this is feasible, it does expand the footprint of the underpass works, would need further discussion and agreement with

KiwiRail, and is a cost element not currently captured in either the AT or CSRA analysis.

- **CPTED:** The April 2014 report includes a 2 page letter from Matrix Security comparing the underpass favourably to the Cowie Street bridge option. In contrast, the AT SAR includes a robust, 25 page report from Scope Investigations considering the Furneaux Way, Cowie Street bridge and underpass options and concluded that of the three options, the underpass adheres least to CPTED principles and the Cowie Street bridge provided the best adherence. Two significant points of difference are the lack of natural surveillance and the creation of entrapment spaces inherent to underpasses.

At the 5th June meeting with CSRA, AT was advised that CSRA had engaged Harrison Grierson to provide CPTED input into the underpass option. Following the meeting, AT was unable to obtain permission from CSRA for Scope Investigations to meet with Harrison Grierson.

The CSRA August 2014 report removes the letter from Matrix Security and replaces it with a more comprehensive analysis by Harrison Grierson. AT would in general agree with the comments in this report, and there are a number of mitigations that could be undertaken to improve the CPTED outcome of an underpass.

However, elements remain unconsidered. Firstly, as highlighted by Opus (Appendix 6), incorporating these CPTED improvements in the underpass design may either not be possible, or come with significant additional cost. The shortening of the underpass length is unlikely to be possible given the need to retain vehicle and plant access for KiwiRail either side of the underpass. The other items identified, principally widening of the underpass, chamfering of the northern entrance and widening of the footpath to 2m, each come with an additional cost and construction complexity. These elements do not appear to have been included in the CSRA report's estimate of \$5.6M.

Secondly, the Harrison Grierson report confines its scope to alterations that could be made to an underpass design to improve CPTED. There is no consideration of this option against the other feasible options identified for vehicle, pedestrian and cycle access. AT has not considered any one option in isolation, and it is the view of both AT and Scope that a more CPTED-friendly underpass will still be a substantially less desirable CPTED outcome than a bridge from Cowie Street. We believe this position is supported by CPTED best practice, including the NZTA Urban Design Policy, particularly around minimising opportunities for concealment and entrapment, minimising gradients for pedestrians and providing unobstructed sightlines.

- **Traffic safety and pedestrian connectivity:** The traffic safety analysis in the CSRA April 2014 report is a high-level, initial analysis identifying one significant concern and recommending further consideration of the underpass option. In contrast, AT's 2013 investigation included a 14 page review prepared by TPC, which analysed two underpass concept design variants by Opus and identified 2 minor concerns, 1 significant concern and 4 serious concerns with the underpass designs.

While some of these concerns have been mitigated by the CSRA design variant, there remains significant challenges and compromises to providing safe access into and out of Laxon Terrace and Youngs Lane. For example, providing wheelchair-accessible gradients or addressing the limited visibility are not able to be fully mitigated, leaving a compromise solution.

TPC and Parlane and Associates met on 19th June to discuss the traffic safety of the underpass proposal. John Parlane was unaware of the TPC traffic safety report

prepared in 2013. This report had been previously provided to the CSRA as part of the project SAR documents, but it is unclear why this was not passed onto their consultant for comment.

The CSRA August 2014 report contains a further 2 page letter from John Parlane summarising his discussion with Bryce Hall of TPC. AT would agree that the traffic safety issues do not render the underpass option unfeasible, but maintain that they are a relevant factor that compares unfavourably to the Cowie Street bridge option. In addition, traffic safety mitigations will require further cost to address that is not included in either the CSRA estimate of \$5.6M or AT estimate of \$8.2M.

Commentary from TPC on the August 2014 report is included in Appendix 7, including a comparative matrix between the underpass and bridge options. It should be noted that the minor traffic safety items identified for the Cowie Street bridge design can be easily rectified by design changes, whereas the underpass traffic safety items cannot be completely mitigated and will in several cases entail additional cost, for example, to address the adverse road crossfall for traffic turning left out of an underpass onto Laxon Terrace.

## **Conclusion**

When the PCC and CSRA members approached AT in 2013 to investigate further into an underpass option at Sarawia Street, the alignment proposed did address some of the reasons why the option was eliminated initially, and warranted further investigation.

However, while AT's investigation confirmed that the underpass was physically feasible to construct, our SAR analysis demonstrates that it did not present a superior alternative to the other options shortlisted for consideration. Accordingly, this was not the option recommended to be progressed.

The CSRA 2014 proposal promised to reveal an innovative approach to an underpass design and construction that overcame the issues and risks identified by AT's analysis of the option, and accordingly justify a reassessment of the Cowie Street bridge option being progressed.

Both the April 2014 and August 2014 CSRA reports do not convincingly make the case for overcoming the principal issues associated with an underpass at Sarawia Street:

- High risk and disruptive construction phase when compared to alternative options;
- Most challenging CPTED concerns compared to alternative options;
- Significant traffic safety challenges when compared to alternative options; and
- A low benefit-cost ratio when compared to alternative options.

Overall the underpass option, although a technically feasible if challenging option, still retains significant construction risks, rail disruption, CPTED concerns and traffic safety challenges. AT does not agree with the underpass design assumptions that have led to the substantially lower cost estimate prepared for the CSRA report.

Accordingly, it is considered that the Cowie Street bridge option remains a superior option to the underpass option prepared for the CSRA.

## Appendices

Number	Description
1	Images of the proposed underpass location
2	CSRA April 2014 Report
3	CSRA August 2014 Report
4	Minutes of Opus meeting with HFC on 20th June 2014
5	Opus report on CSRA April 2014 Report
6	Opus report on CSRA August 2014 Report
7	Traffic Planning Consultants letter regarding meeting with John Parlane
8	Images of KiwiRail Bridge 3 MSL

## Document Ownership

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## Glossary

Acronym	Description
<b>AEP</b>	Auckland Electrification Project
<b>AT</b>	Auckland Transport
<b>CPTED</b>	Crime Prevention Through Environmental Design
<b>CSRA</b>	Cowie Street Residents Association
<b>HFC</b>	Harris Foster Consulting Group
<b>PCC</b>	Parnell Community Committee
<b>SAR</b>	Scheme Assessment Report
<b>TPC</b>	Traffic Planning Consultants

## Appendix 1: Images of the Proposed Underpass Location



Fig 1 – View of Level Crossing from Sarawia Street. Proposed underpass would be accessed via road extension turning to the right hand side.



Fig 2 – View South from level crossing. Underpass and road extension proposed to be located between embankment and KiwiRail retaining wall on the right. Underpass road surface would be 5m below track level.



Fig 3 – View of Sarawia Street from Level crossing.



Fig 4 – View of Laxon Terrace from the Level crossing.



Fig 5 – View towards the Level crossing from Laxon Terrace. Red framed window shows approximate location for underpass entrance/exit that is opposite a residential property.

**Appendix 2: CSRA April 2014 Report**

See attached.

## **Appendix 3: CSRA August 2014 Report**

See attached.

**Appendix 4: Minutes of Opus meeting with HFC on 20th June 2014**

See attached.

**Appendix 5: Opus report on CSRA April 2014 Report**

See attached.

**Appendix 6: Opus report on CSRA August 2014 Report**

See attached.

**Appendix 7: Traffic Planning Consultants letter regarding meeting with John Parlane**

See attached.

## Appendix 8: Images of KiwiRail Bridge 3 MSL



Fig 1 – Bridge 3 MSL before damage



Fig 2 – Temporary repairs following earthquake



Fig 3 – Bridge 3 MSL following construction.



Fig 4 – View of completed Bridge 3 MSL from rail.