

11 May 2018

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Dear Rachelle

**SH3 Mt Messenger Bypass  
Response to Applicant's Responses to S92 Information Requests**

I have read the Applicant's responses dated 6 April 2018 to the S92 matters you raised. I responded to the majority of the responses in my letter dated 1 May 2018. I subsequently visited site on the 8 and 9 May 2018 and provide the following comments with regard to the questions below that you raised in your email dated 9 April 2018.

- [Has sufficient work been undertaken to date to be satisfied that the geotechnical characteristics of the project area are well understood?](#)

The documentation lodged by the applicant does not detail the nature and extent of the geotechnical work completed to December 2017, the date of the Geotechnical Appraisal Report (GAR). However, the GAR does reference the Opus Geotechnical Factual Report and Addendum dated May and August 2017, respectively, although I have not yet seen copies of these documents.

A plan showing the completed exploratory holes to date was received via email on 4 May 2018. Based on the distribution of the exploratory holes shown on this plan and the engineering geological mapping of the area of the large landslide, I consider that the applicant has a general understanding of the geotechnical characteristics of the project area. However, as stated in numerous sections of the GAR, the applicants understanding of the ground conditions at the time the GAR was written was based on limited geotechnical investigations and I consider there are clear gaps in their understanding.

In particular, in section 3.2.4 it is stated that no data is currently available on groundwater depths. The assumptions made in the GAR with regard to expected groundwater levels and flows appear to be reasonable but without specific data on groundwater there is a risk that additional works will be required that could lead to additional costs.

Similarly, in section 5.2.3 it is stated that based on preliminary analysis and assessment of limited investigation data, the risk of significant liquefaction and lateral spreading is low and that further investigations and laboratory testing are required. I note that under item 1 on page 8 of the Resilience Assessment (Technical Report 3) the applicant states that liquefaction is typically low risk and that the project is less exposed to damage from liquefaction and lateral spreading in an earthquake than the existing route due to current design practices. Since significant sections of the proposed route are to be constructed on medium to high embankments that traverse areas that are indicated to be underlain by very soft, saturated and compressible soils, I consider the potential for liquefaction is likely to be greater than indicated and the risk higher than for the existing route and is likely to require additional engineering solutions. It is not clear if allowance for such engineering solutions has been included in the cost estimate.

It is stated that further investigations are planned to determine the geotechnical conditions at the cuttings, embankments, bridge, tunnel, retaining walls, culverts and potential borrow/disposal areas. The findings of these further investigations could result in additional engineering solutions and/or more robust and costly solutions being required.

- Please summarise the main geotechnical issues.

The main geotechnical issues that relate to the Option E alignment include:

1. Stability of deep cuttings, largely in rock, with soil / weathered rock near crest that require suitable stabilisation and rockfall protection measures. A thorough understanding of the rock fabric and defects is required. It is noted that the majority of the ten cuttings are significantly deeper (30m to 60m) than the cuttings on the existing route (20m) and therefore without robust engineering design I consider they could pose a greater risk to resilience than the existing route.
2. Stability of embankments on weak compressible soils and measures to mitigate long term settlement that may require on-going maintenance. The applicant estimates settlements of between 0.5m and 1m are anticipated during construction but has not indicated what longer term settlements are likely to be. The potential for liquefaction and lateral spreading has also not yet been determined and could require significant ground improvement measures to mitigate the effects on the embankments.
3. Stability of high embankments on elevated terrain and incised gullies. Until ground conditions are better understood there is a risk that additional ground improvement and retaining structures will be required.
4. Design and construction of suitable drainage measures for deep cuttings and beneath embankments. In particular the construction of the long culverts beneath embankments on very soft and compressible soils where settlements of up to 1m are expected during construction.
5. Design and construction of bridge foundations.
6. Design and installation of tunnel support requirements.
7. Stability and de-watering of excavations below groundwater level.
8. Suitability of excavated materials for re-use as fill and management of these materials during construction, particularly in wet weather. It is noted that much of the existing valley floors are saturated and the northernmost valley is prone to fog and flooding. Prolonged damp and wet conditions will make drying the soils problematic and could result in significant delays to the earthworks programme. The use of lime and cement could be used to improve the soils, subject to confirmatory laboratory testing, although their use is likely to increase the cost of the earthworks.
9. Construction and maintenance of haul roads, particularly on the very soft, saturated and compressible soils within the Mangapepeke Stream valley.
10. Stability of suitable disposal areas for spoil materials, particularly on the very soft, saturated and compressible soils within the Mangapepeke Stream valley.

- Are you satisfied that the project is feasible within the proposed footprint? Are there engineering solutions to the challenges?

The applicant has based the designation on assumed cut batter slopes of 45 degrees with an additional 10m reserve. This allows sufficient space for the proposed typical cut profile to be constructed within the designation. In cases where ground conditions may be not be suitable for such slope batters, soil nails and rock bolts may be used to form steeper cut slopes. As such, I consider the project is feasible within the proposed footprint.

- Is the level of detail in the preliminary design acceptable and is it acceptable to leave all further detail to detailed design stage?

I believe the level of detail in the preliminary design is a reflection of the available geotechnical information at the time. I consider it is sufficient to make an informed opinion on the route option and it is acceptable to leave further detail to detailed design stage. However, there is a risk that as more geotechnical information becomes available, the cost of earthworks and ground improvement may increase.

- Do you think peer review of detailed design is justified?

For a project of this nature and complexity I consider a peer review of detailed design is essential.

- Section 3.2.3 of the GAR considers an extensive landslide over which the current SH3 route passes north of the Mt Messenger tunnel. This is also discussed on page 5 of Technical Report 3 (Resilience). In considering the Options Assessment, a key factor in selecting the proposed route instead of doing online improvements was this landslide and the costs associated with significant ground improvements. Please consider the response to Question 11a and 11c of the letter. You may wish to discuss with Graeme Doherty who has a good understanding of the MCA carried out. How significant is this landslide and is its presence a key determining factor in route selection?

The applicant has provided little detail in the lodged documents with regard to the landslide, the findings of the geotechnical investigations in this area, or the proposed ground improvements required for Option Z. A plan received via email on 4 May 2018 shows the mapped extent of the landslide (see below). The northern part of the landslide is indicated to be dormant while the southern part is indicated to be active. The existing SH3 appears to traverse approximately 600m of this active landslide. However, it is understood that little maintenance has been required over this section.

During my site walkover of the active landslide on 9 May 2018, I saw little evidence of active movement in the vicinity of the existing SH3 or on the slopes above to the east. Hummocky ground, scarps and ponding water is evident to the west and I would anticipate ground improvement measures would be required for construction of embankments across this area.

I note that in the email correspondence received on 4 May 2018, the proposed design along this section of Option Z includes for a 1.5km long soldier piled retaining structure. The use of MSE structures may be a cheaper alternative to enable steeper embankment side slopes to be constructed on the sideling ground, although this would be subject to the findings of the geotechnical investigations carried out within the landslide area.

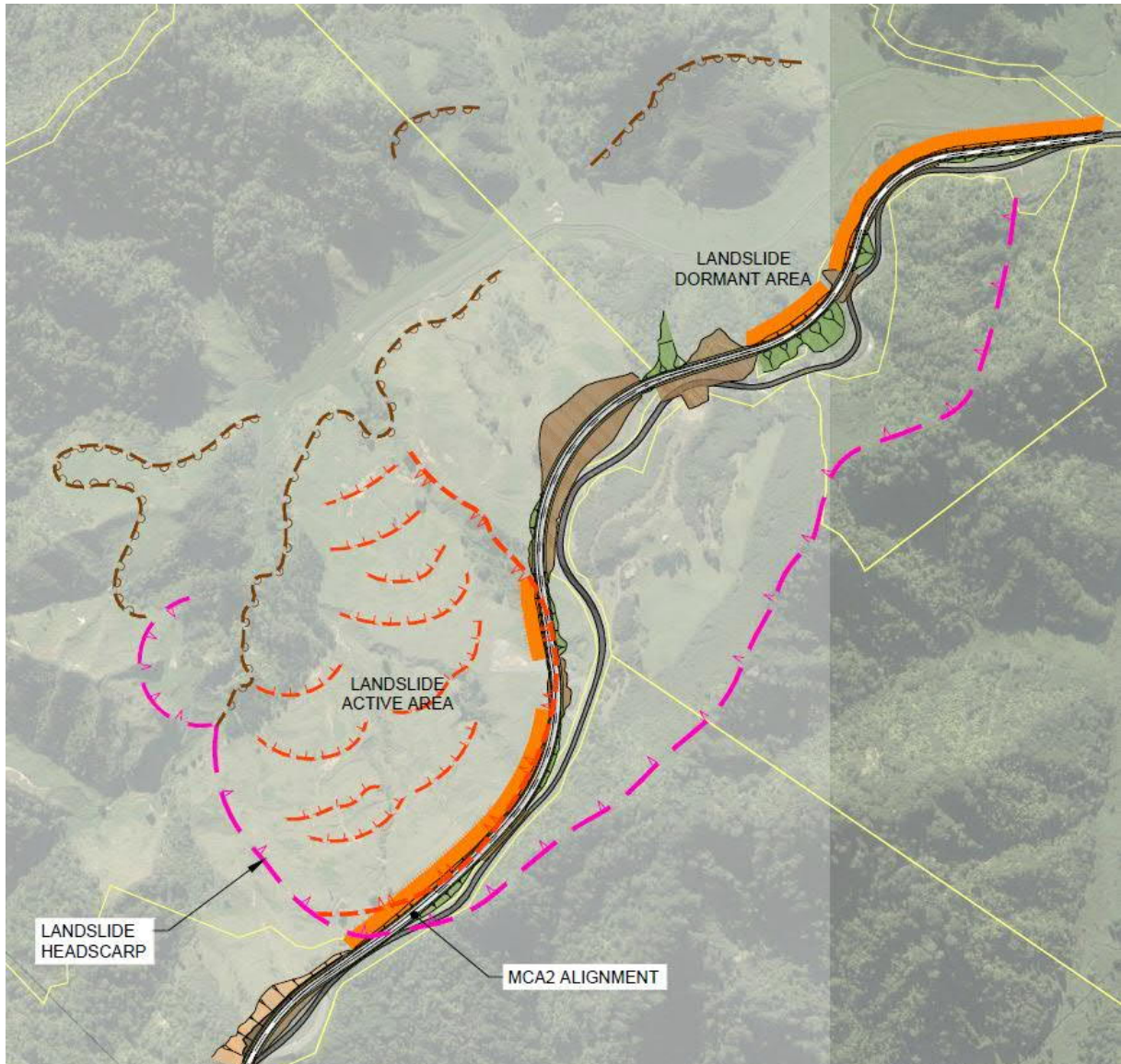
The presence of the landslide would certainly influence route selection in this area since it does pose a risk to resilience. Given the indicated significant cost of \$112M in constructing the retaining structure across this area, I would have thought consideration could be given to relaxing the design requirements for the proposed route along this section. A reduced design speed could allow the existing SH3 adjacent to the landslide, which includes a passing lane, to be retained. Alternatively, consideration could be given to minor improvements, including widening by retreat into the upslope area, again subject to satisfactory geotechnical investigations.

Yours sincerely



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Extract from plan showing landslide to north of Mt Messenger tunnel received by email 4 May 2018