BLOXAM BURNETT & OLLIVER

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Memorandum From:	Siva Balachandran		
To:	To Whom It May Concern	**Project No:**	145530
CC:	Roger Pryce	**Date:**	8 May 2018
Subject:	Pavement Impact Assessment for Proposed Hill Road Quarry - Revision 1		

Introduction

This memorandum relates to the proposed CARO Limited Quarry at Hill Road, Te Aroha. The site is expected to generate up to 30 truck and trailer loads of material on days of high demand and no traffic during wet weather. These vehicle movements will result in increased loads on the road pavement overlays. This memorandum evaluates the pavement impact and the associated maintenance cost.

A truck and trailer unit is considered a Heavy Commercial Vehicle (HCV) in this assessment.

Recommendations are made to ensure that any pavement impacts from this site are appropriately addressed.

Proposal

CARO Limited has proposed to develop a quarry to extract rock and fill. The quarry will extract approximately 35,000m^3 of material per year and will operate from 7.00 am to 5.00 pm on weekdays, with a maximum of 30 truck and trailer loads of material extracted from site on any given day. The truck and trailer unit used on site will have a payload of 27 tonnes and will be able to transport approximately 18m^3 of material.

Access to the quarry will be via the existing farm road at the eastern end of Hill Road.

Due to the location of the site is at the end of Hill Road, all vehicles to and from the site will utilise Hill Road to exit site. It is expected, based on Harrison Transportation's traffic assessment dated 19th February 2018, that all vehicles will turn left onto Rawhiti Road south of Hill Road. This is because that the local road controlling authority prohibits HCVs access the site from Rawhiti Road north of Hill Road.

Hill Road and Rawhiti Road Pavement Loading

The existing AADT on both carriageways are shown in the table below.

Table 1: Existing AADT on Hill Road and Rawhiti Road

Road / Route	AADT (vehicle per day)
Hill Road	79
Rawhiti Road South of Hill Road	282

The proposed quarry is expected to increase the AADT on Hill Road and Rawhiti Road. For both carriageways, the expected increase in HCV volumes have been used to determine the additional pavement loading. This assessment uses the following parameters in calculation:

- A loaded aggregate truck and trailer HCV (the aggregate HCV) carries approximately 18m^3 of material.
- There will be up to 30 truck and trailer units per day on Hill Road and Rawhiti Road south of Hill Road.
- Approximately 1,944 aggregate HCV loads per year on Hill Road.
- Approximately 1,944 aggregate loads, i.e. 100% of the HCV movements will be travelling to and from Rawhiti Road, south of Hill Road.
- Loaded HCVs will be travelling in the westbound lane only along Hill Road and the southbound lane Rawhiti Road south of Hill Road. Therefore, the associated pavement impacts will be limited to these lanes only.

Further assumptions for this assessment include:

- The Equivalent Standard Axle (ESA) value per HCV that was used to calculate the existing ESA volume is 1.67 ESA/HCV.

  The average ESA per vehicle was obtained based on the detailed axle weight data and vehicle types recorded at the six WIM sites around New Zealand[1].
- The ESA load factor for aggregate carrying heavy vehicle that was used to calculate the proposed additional ESA volume imposed by the quarry is 3.3 ESA/HCV.

  Based on engineering judgement, an average of the load factors for aggregate carrying HCVs was calculated to obtain the figure of 3.3 ESA/HCV [2].
- The design subgrade CBR used for this assessment is 5.
- The pavement is nearing the end of its life and hence requires full rehabilitation.

[1] *Source: NZTA Pavement Cost Impact Bus & Truck Axle Loads document*
[2] *Source: Impact of Heavy Vehicle Traffic on Road Pavements document from RCA Forum NZ*

Cost Impact

The following process is followed in the pavement maintenance cost impact:

a) Current traffic loading in terms of ESA over a 25-year period is first calculated based on the existing ADT.

b) Then the additional HCV movements associated with the proposed quarry is considered and the future traffic loading in terms of ESA for a 25-year period is worked out.

c) Using Austroads pavement design for rural roads, the increase in pavement thickness to accommodate the additional quarry truck and trailer units over the 25-year design period is determined.

d) A preliminary analysis identified that over a 25-year period, there is a cumulative pavement loading increase of approximately 50% for the length of Hill Road and 37% along Rawhiti Road south of Hill Road.

Appendix A presents the calculations for this method.

Based on this method, the additional pavement maintenance cost is approximately $55,650. As 50% of local road maintenance is subsidised by the New Zealand Transport Agency road user charges, the additional aggregate HCV levy attributable to CARO Limited is $27,825. This equates to an indicative impact levy of $0.57 per quarry loaded aggregate HCV.

Conclusion and Recommendations

It is concluded that based on the expected travel route of all aggregate HCV loads travelling on Rawhiti Road to and from the south, CARO Limited can expect to pay $0.57 per truck and trailer load for the proposed quarry at Hill Road.

It is understood that currently it is prohibited for any HCVs to access the quarry from the north. Nevertheless, if the condition is uplifted in the future, the directional split to Rawhiti Road north or south of Hill Road could may vary. Subsequently, it will affect the levy per quarry HCV load.

Moreover, to fully quantify and predict the quarry pavement effects on Hill Road and Rawhiti Road pavements, the existing pavement physical conditions and traffic flow characteristics for both lanes must be identified in a detailed site investigation. It will allow a more accurate pavement maintenance levy contribution to be calculated and agreed with the relevant local road controlling authority prior to site development.

1) If the pavement investigation determines that the road is currently in good condition, then the reduction in remaining pavement life can be determined. With that, the proportion of the cost to the local road controlling authority to bring this work forward attributed to quarry traffic loading can be calculated.

2) If the pavement investigation determines that the pavement is at or near the end of its life and requires strengthening, then the proportion of these works attributable to the quarry can be calculated.

For either scenario, a subsidy from the New Zealand Transport Agency would be included to cover part of the additional road maintenance cost. The remaining will be funded through road levy by CARO Limited.

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