Appendix 3 – Professor Elms 2002 report on Road Safety in Waihi

Road Safety in Waihi Hazardous Zones

Report to Hauraki District Council

D G Elms 2 October 2002

Introduction

This report assesses the safety to vehicles using routes crossing the hazardous zones in Waihi identified in the GNS report *Waihi Underground Mine Workings Stage II Investigations*.

There are various methods of quantifying risk to life. The GNS Report concentrated only on the risk to people spending a great deal of time in the hazardous zones by way of living there or having their employment there. They used measures of safety related to the risk faced by individuals or, using the ANCOLD criteria, to groups.

With regard to traffic safety, the issue is whether the local authorities should close or otherwise regulate the flow of traffic on roads crossing the identified hazardous zones. Presumably what the authorities want to know is the likelihood of a fatality on the road due to mine subsidence. We'll therefore try to estimate the annual likelihood of a death occurring due to this cause.

Fatality Rate

The annual probability of a collapse occurring somewhere in each lode is given on p54 of the GNS report. We need to calculate from this the annual probability of collapse occurring in a particular place on the lode, presumably where the route crosses it. We'll think of it as the probability of collapse in a 70 m length of the lode, assuming that this is the lode length that might affect a route. We'll express this in terms of probability of collapse per hour as this is the figure we can use for estimating vehicle risk.

Lode	Annual Prob. of a Collapse	Approx Lode Length (m)	Prob. of collapse in 70 m length/yr	Prob. of collapse in 70 m length/hour
Royal	0.0384	1000	2.7 x 10-3	3.1 x 10-7
Edward	0.0068	220	2.2 x 10-3	2.5 x 10-7
Empire	0.0392	400	6.9 x 10-3	7.8 x 10-7

The next step is to look at the risk facing a specific vehicle. We'll assume that if the vehicle is involved in an accident due to subsidence, there is a 20% chance of a fatality. Assume also that the vehicle is travelling at 50 km/hr. We'll only look at the high hazard zone – the risk for the moderate zone reduces to a tenth. At this stage we can be pretty

rough as to our assumptions in order to get a very broad estimate as to whether vehicle safety is an issue. If it might be an issue, then we can return to our assumptions and refine them further.

Route		AADT	Length over high hazard zone (m)	Time spent per vehicle (hr) @ 50 k/hr	Prob of collapse per vehicle	Fatality rate, deaths per year
1	Edward	1250	60	.0012	2.96 x 10-10	2.7 x 10-5
2	Royal	1200 (say)	100	.002	6.14 x 10-10	5.4 x 10-5
3	Royal	1270	60	.0012	3.68 x 10-10	3.4 x 10-5
3	Empire	700	130	.0026	20.36 x 10-10	10.4 x 10-5
					Total	21.9 x 10-5

Next, a rough estimate of the normal road safety level.

New Zealand has about 91,200 km of road of all types, and about 420 people are killed a year. This gives a rough figure of 0.0046 deaths/km/yr.

Assuming there are about 20 km of road in Waihi, then you would expect about 20 x 0.0046 = 0.09 or, say, about 1 death in 10 years. Compare this to the above figure of fatality rate in the hazardous zones of 21.9 x 10-5, which translates to about 1 death in 5,000 years. It is of the order of 500 times less risky than the ambient figure. This does not mean that a fatality could not occur due to subsidence: it could. But its likelihood is very low. We need not refine our assumptions further to tease out detail.

To put it another way, I'd personally have no hesitation in driving on any of the three routes myself.