

9 Investigation of the preferred option

9.1 The preferred option

The main objective of the preferred option is to improve road safety. However, the option still needs to satisfy the remaining three objectives:

- Improve road transport productivity, efficiency and reliability of travel
- Minimise the impact on the natural, cultural and built environment
- Provide value for money.

9.2 Development of the preferred option

The development of the preferred option involved the following steps:

1. Agreement on the objectives of the preferred option (refer above).
2. A site inspection was held on 17 April 2013 attended by senior engineers, designers and safety experts from both RMS and Cardno to assess the documented and potential safety problem locations.

Reference was made on site to detailed crash data (refer to **Section 2.3.1** and the Detailed Traffic Assessment Report in **Appendix A**). The tow away, injury and fatal crashes for the period March 2008 to February 2013 are shown in **Figure 9-1**.



Figure 9-1 Crash locations

The team agreed that, as a minimum, a road safety option must address the concentration of accidents that includes the three fatal accidents on the substandard bend on the steepest part of the route (refer to **Figure 9-1**).

3. A workshop was held in Tenterfield following the site inspection to develop solutions to the safety problems. The workshop explored options that would resolve the safety issues while retaining as much of the existing alignment as possible. Relaxation of design criteria was discussed to help in

reduction of costs. The horizontal alignment should achieve a design speed of 100 kilometres per hour; however, the vertical alignment could be reduced to 90 kilometres per hour to enable much of the existing vertical alignment to be retained.

All options would also only require one lane in each direction as it had been previously established that there was no warrant for overtaking lanes (refer to **Section 7.5.3**).

4. Approval to revise design criteria was obtained from RMS internal experts subsequent to the workshop. The revised criteria are detailed in **Section 6.1.1**.
5. A design was developed using the revised design criteria. This option was designated Option 7a as it is a sub-option of Option 7. A refinement of Option 7a was also developed by making minor adjustments to the horizontal alignment and reducing shoulder widths from 2.5 metres to 2.0 metres to reduce the cost. This option was designated Option 7b.

Options 7a and 7b are shown in **Figure 9-2** and described in **Section 9.3**.

6. A strategic estimate of cost and an economic evaluation were undertaken for each option.

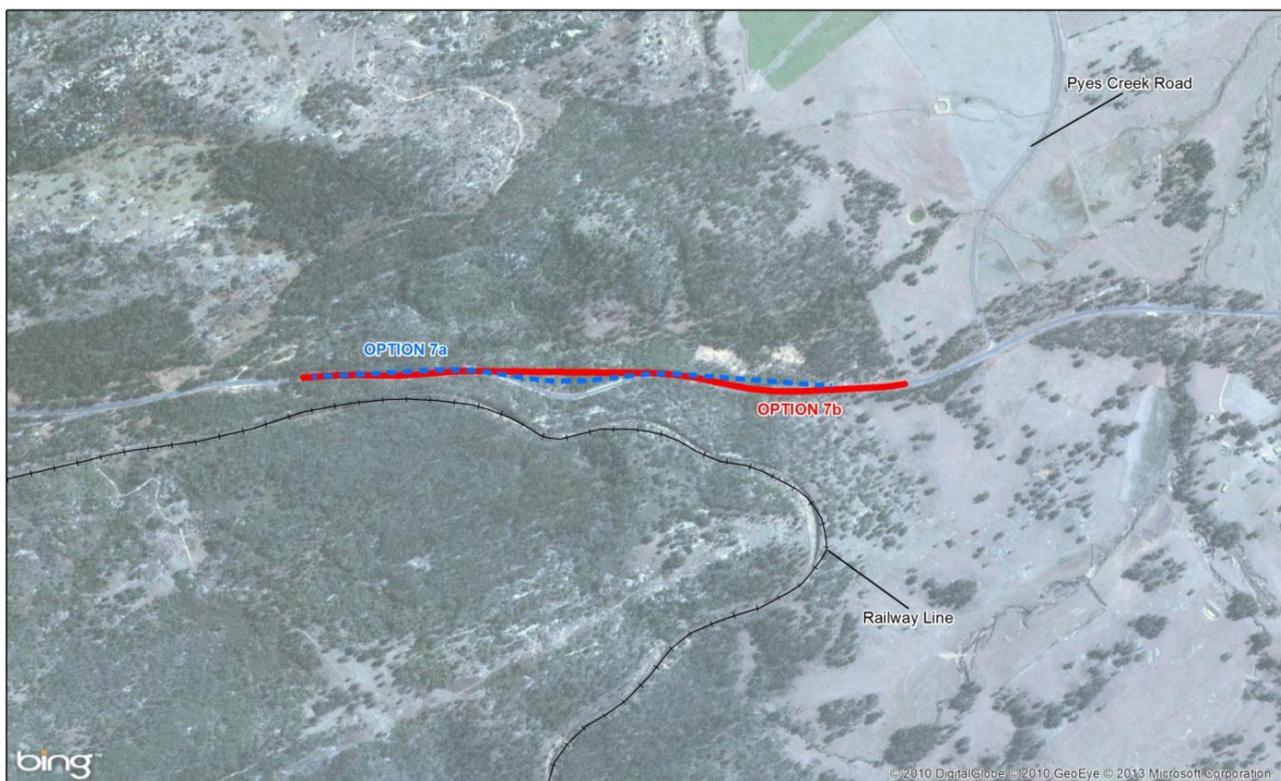


Figure 9-2 Options 7a and 7b

9.3 Description of the options

9.3.1 Option 7a

Option 7a is a sub-option of Option 7. The option has a cross section consisting of one northbound lane, one southbound lane with 2.5 metre wide shoulders on either side.



Figure 9-3 **Option 7a**

The key features of this option are:

- Option 7a is 1400 metres long and starts approximately 500 metres further north and finishes approximately 450 metres further south than Option 7
- As with Option 7, this option was developed to demonstrate a minimalist treatment of straightening out the bends in the steepest part of the highway. It has non-conforming grades up to 8.1 per cent in order to shorten the length and starts approximately 900 metres north of the other options
- The first 150 metres consist of a simple widening of the existing carriageway to the west in fill to provide adequate shoulder width
- The next 435 metres will require extensive retaining walls to keep the fill out of the creek line
- A major bridge up to 230 metres long will then be required to keep the road out of the creek line
- From the northern abutment, at about eight metres high, extensive retaining walls approximately 350 metres long are required to keep the fill out of the creek line
- Fill then tapers back 230 metres to the existing highway
- Estimated cost \$80 million.

9.3.2 **Option 7b**

Option 7b is a refinement of Option 7a and although longer, it minimises the requirement for the long lengths of retaining walls. As with Option 7a, the option has a cross section consisting of one northbound lane and one southbound lane, however, the shoulders are narrowed to 2.0 metres wide on either side. A shoulder width of 2.0 metres is considered the minimum acceptable width to allow a maintenance truck to safely park beside the traffic lanes.

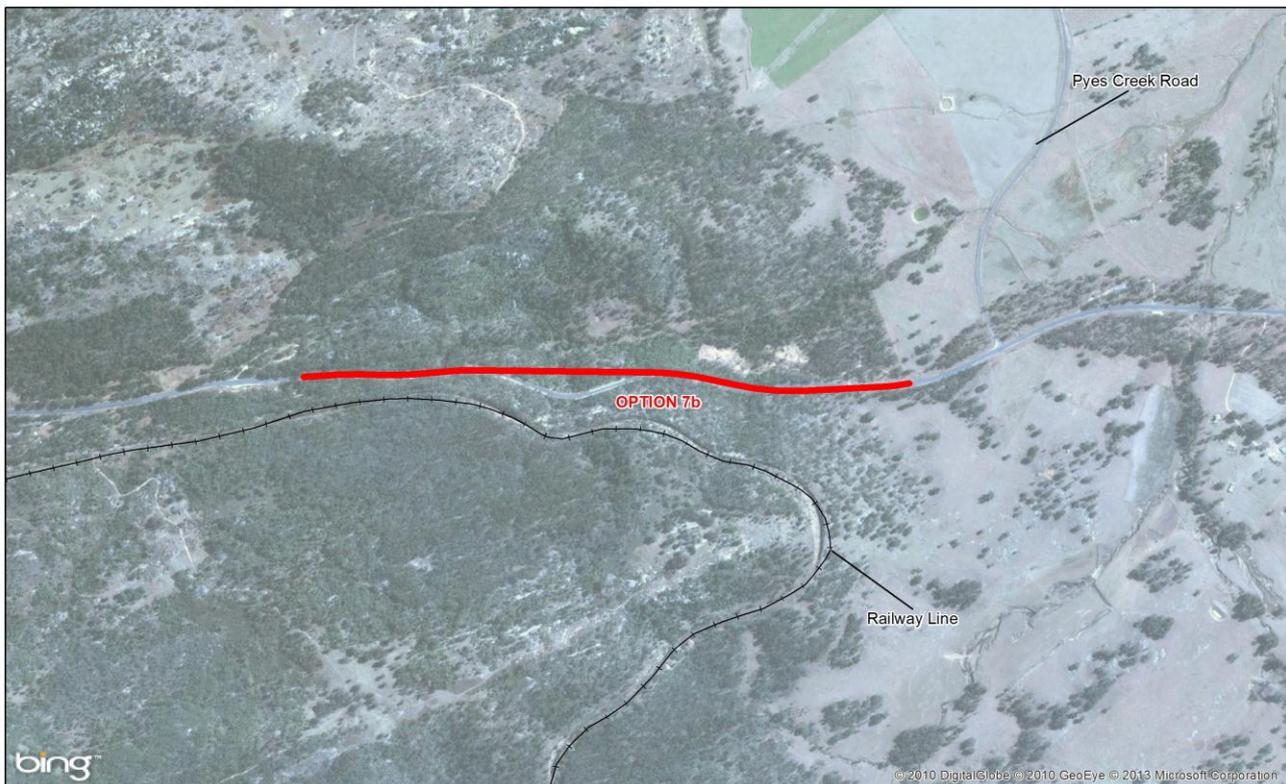


Figure 9-4 **Option 7b**

The key features of this option are:

- Option 7b is 1635 metres long and starts approximately 475 metres further north and finishes approximately 240 metres further south than Option 7
- As with Option 7, this option was developed to demonstrate a minimalist treatment of straightening out the bends in the steepest part of the highway. It has non-conforming grades up to 8.1 per cent in order to shorten the length and starts approximately 900 metres north of the other options
- The length and height of the retaining walls are reduced by narrowing the shoulders to 2.0 metres. The rock face next to the shoulder in the southbound lane is softened by casting a single sided Type F concrete barrier against the rock face
- The first 210 metres consist of a simple widening of the existing carriageway to the west in fill to provide the required shoulder widths.
- The next 265 metres will require a retaining wall of up to three metres high to keep the fill out of the creek line
- As the alignment diverges from the existing carriageway over the next 75 metres, the road will be widened by a cantilevered concrete structure on concrete piles
- The cantilevered concrete structure leads into a major bridge up to 360 metres long which is required to keep the road out of the creek line
- At the northern abutment of the bridge, a 60 metre long cantilevered concrete structure on concrete piles is again used to ease the alignment back towards the existing carriageway. The rock face next to

the southbound shoulder is softened by casting a single sided Type F concrete barrier against the rock face

- The next 110 metres widen out the existing carriageway, requiring a retaining wall of up to 2 metres high on the western side. The rock face next to the southbound shoulder is softened by casting a single sided Type F concrete barrier against the rock face
- The next substandard bend is straightened out by gently moving off the existing alignment to the west and then re-joining the existing carriageway 145 metres further along
- The alignment to straighten out the bend requires the next 150 metres to move to the east of the existing carriageway by cutting into the rock face. At this location, the angled rock face beside the road is flattening out, requiring only minor cut. The rock face next to the southbound shoulder is softened by casting a single sided Type F concrete barrier against the rock face
- Fill then tapers back 255 metres to the existing highway
- Estimated cost \$60 million.

9.4 Strategic concept design cost estimates for the options

The approach to estimating the cost of the options was the same as for the shortlisted options (refer to **Section 8.6**). **Table 9-1** represents the strategic cost estimates for each of the options. As with the previously shortlisted options, the cost estimates include an average contingency of approximately 60 per cent based on a risk assessment of project parameters.

Table 9-1 Cost estimates

| Options | Base Cost | Contingency (60%) | Total Cost |
|-----------|--------------|-------------------|--------------|
| Option 7a | \$50,000,000 | \$30,000,000 | \$80,000,000 |
| Option 7b | \$38,000,000 | \$22,000,000 | \$60,000,000 |

9.5 Economic appraisal of the options

The results are shown in **Table 9-2**.

Table 9-2 Summary of economic analysis

| | Option 7a | Option 7b |
|-------------------|-----------|-----------|
| NPV* (\$ million) | -\$40.4 | -\$24.1 |
| BCR* | 0.39 | 0.52 |

*NPV = Net Present Value

*BCR = Benefit Cost Ratio

Neither of the options produces a positive economic return. As with the previously shortlisted options (refer to **Section 8.7.2**), sensitivity analysis was not undertaken at this stage.

The outcomes of the analysis suggest that all options considered have a BCR of less than 1.0, where the overall costs exceed the benefits of the works. However, based on the assessment to date, Option 7b has the highest benefit cost ratio and therefore would represent the best possible outcome economically of the five route alternatives shortlisted.

9.6 Evaluation of the options

The options were examined in a value engineering workshop on 1 May 2013 attended by the RMS and Cardno teams that included safety experts from both organisations, and Transport for NSW personnel.

During the workshop it was noted that even though Option 7b was 235 metres longer than Option 7a and contained a bridge 130 metres longer than the bridge in Option 7a, the estimate of cost was \$20 million less.

This difference is mainly due to a reduction in the height and length of retaining walls achieved by reducing the shoulder widths from 2.5 metres to 2.0 metres in combination with small adjustments in the horizontal alignment. The cost is very sensitive to the width of widening out from the western edge of the existing road.

Following a review of the previously shortlisted options 2, 6, 7 and 10, the workshop concluded that:

- Both options met the project objectives as well as, or better than, the four previously shortlisted options
- Option 7b, at an estimated cost of \$60 million, represents better value for money than Option 7a at an estimated cost of \$80 million.

In summary, Option 7b:

- Improves road safety by smoothing hazardous horizontal curves and widening the road shoulders, improving safety through better visibility, resulting in less risk of crashes
- Improves road transport productivity, efficiency and reliability of travel by providing a 100 kilometres per hour alignment. Trucks will be limited to 80 kilometres per hour downhill due to the 8.1 per cent slope (they are currently limited to 60 kilometres per hour)
- Minimises the impact on the natural, cultural and built environment. It has the least impact of all options studied. Option 7 previously rated best on this objective (refer to **Section 7.5.1**). Option 7b is approximately 715 metres shorter than Option 7 and its footprint lies substantially within the Option 7 footprint
- Provides value for money. Option 7b has the least cost of all options considered and shows the most favourable cost benefit ratio.

Workshop participants therefore agreed that Option 7b should be taken forward as the recommended preferred option.

9.7 Recommendation

Option 7b was presented to the MPRC on 23 May 2013 with the recommendation that it be taken forward to the next stage of the project as the preferred option. The MPRC agreed that the Recommended Preferred Route Option Report be finalised with **Option 7b** as the preferred option for community consultation.

Consideration of design elements will be undertaken in the next stage of the project after the consultation period.