

## 7 Evaluation of Long List of Route Options

### 7.1 Methodology

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The assessment process was initially conducted on a zone-by-zone basis for the zones and sections described in **Chapter 6**. By considering the nodes within each zone where it would be possible to switch from one section to another, a long list of possible section combinations or route options within each of the three zones was generated, resulting in:

- Tintenbar Zone – 9 route options.
- Newrybar Zone – 18 route options.
- Bangalow Zone – 28 route options.

By considering the various section combinations within each zone, the Sieve 1 evaluation process (see **Section 2.1**) allows identification of the best performing section combinations, avoiding the possibility that an entire corridor within a zone could be eliminated simply because it performed poorly in one section. Application of Sieve 1 and the pairwise, as described in **Sections 7.2** and **7.3**, allows the long list of route options within each zone to be compared and the best performing route options within each zone to be identified.

Because highly ranked route options from one zone may only connect to a poorly ranked route option from an adjacent zone, the process of evaluation of the long list could not be carried out entirely on a zone by zone basis. As the evaluation process proceeded, it was possible to develop a general grouping of better performing route options within each zone made up of the best performing sections. Those section combinations or route options which perform well within each zone were then reviewed to identify the better performing options within each zone that can also connect to a better performing option in an adjacent zone. This process was necessary to ensure that a section combination which performs well in one zone is not shortlisted if it can only be connected to a poor performing option the adjacent zone(s). Similarly, a section combination which performs only moderately well in one zone may be shortlisted if it can be connected to a good performing option(s) in the adjacent zone(s). This was necessary to ensure that the shortlisted options included the best route options over the full length of the study area.

The evaluation of the long list of options is based on a generic corridor width of 250 m. This corridor represents the area of investigation at this stage of the study and will be refined in later stages of the study to the actual road reserve width requirements. This is the actual land that would be required for the physical roadway (highway and service roads), public utility plant (if required), earthworks and maintenance clearances. On the ground it is generally delineated by boundary fences separating the road reserve from frontage properties and would range from about 80 m to 200 m wide.

### 7.2 Sieve 1 Criteria

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The Sieve 1 evaluation criteria (see **Appendix A**) were measured either quantitatively or qualitatively for all of the route option 'section combinations' described in this chapter.

Based on the results of the measurements (unweighted), the criteria for each option (initially by 'section combination' and then by route option) were assigned a 'performance or level of impact score'. **Appendix B** provides the results of the scoring for each criterion for the long list of route options (by section combinations) and the resulting ranking.

### 7.3 Pairwise

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It is recognised that individuals, interest groups and communities value project specific issues differently. In order to reflect these differing values a 'pairwise' evaluation process was adopted.

The process involves taking one evaluation criterion/measure at a time and selecting whether it is of more or less importance than every other criterion/measure. This process is spreadsheet based and provides a weighting or relative importance for each criterion/measure. The advantage of using a pairwise approach is that it distinguishes between benefits and disbenefits potentially offered by the project rather than reacting to specific impacts or rating all impacts as high.

The pairwise exercise was undertaken with three groups: the Project Team (RTA and Arup), the Planning Focus Group (generally local and state agency representatives) and the CLG. Individuals within these groups were asked to complete a pairwise analysis and the results were combined by group to provide a sensitivity test or set of weightings. The summary results of the pairwise process are presented in **Appendix C**. This summary provides the separate results of the Project Team, agency representatives, and the CLG. The resulting criteria ranking by each group is also provided.

The pairwise results for the Project Team were used as the base case for analysis and those from the CLG and Planning Focus Group were used for sensitivity testing. It should be noted that several members of the CLG felt the results of the pairwise exercise reflected that the CLG was not representative of the community and that the results should not be used in any analysis of the options.

Application of the pairwise in the route selection process is described in the following sections.

### 7.4 Performance of Long List of Route Options

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The results of applying the selection criteria and pairwise analysis for the section combinations of the longlisted sections are tabulated for each zone in **Table 7.1**. The section codes, which identify the path the route has taken, are also shown in this table.

The Bangalow Zone long list of options includes three alignments that utilise a tunnel through St Helena Hill - A6, E6, and H7. Due to the similarity in selection criteria ratings of these sections, E6 was chosen as a typical alignment for the tunnel and tunnel approaches. This rationalised the 28 options into 12 options for ease of comparison.

Performance results are assessed and reviewed on a zone by zone basis in the following sections. The best performing combinations of sections within each zone are considered as potential components of the short list of options.



<b>Bangalow Zone</b>																			
Section Combinations		J2 E6	L3 L4	L3 H6 E6	H5 L4	H5 H6 E6	G2 E6	A5 E6	K2 E6	C6 E5 E6	E4 E5 E6	L3 M1	H5 M1						
Unweighted	Score	152	126	150	124	147	152	159	155	152	155	145	141						
	<b>Rank</b>	<b>4</b>	<b>11</b>	<b>7</b>	<b>12</b>	<b>8</b>	<b>4</b>	<b>1</b>	<b>2</b>	<b>4</b>	<b>2</b>	<b>9</b>	<b>10</b>						
Project Team Weighted	Score	3.77	3.11	3.78	3.06	3.72	3.74	4.00	3.88	3.80	3.87	3.57	3.54						
	<b>Rank</b>	<b>6</b>	<b>11</b>	<b>5</b>	<b>12</b>	<b>8</b>	<b>7</b>	<b>1</b>	<b>2</b>	<b>4</b>	<b>3</b>	<b>9</b>	<b>10</b>						
CLG Weighted	Score	3.90	3.45	3.89	3.34	3.77	3.91	4.07	3.98	3.88	3.94	3.78	3.60						
	<b>Rank</b>	<b>5</b>	<b>11</b>	<b>6</b>	<b>12</b>	<b>9</b>	<b>4</b>	<b>1</b>	<b>2</b>	<b>7</b>	<b>3</b>	<b>8</b>	<b>10</b>						
Agency Weighted	Score	3.82	3.19	3.82	3.11	3.70	3.79	4.04	4.00	3.92	3.99	3.72	3.64						
	<b>Rank</b>	<b>5</b>	<b>11</b>	<b>6</b>	<b>12</b>	<b>9</b>	<b>7</b>	<b>1</b>	<b>2</b>	<b>4</b>	<b>3</b>	<b>8</b>	<b>10</b>						

#### 7.4.1 Tintenbar Zone – 9 options

Of the nine options in this zone, five performed well while the remaining four underperformed by comparison. This conclusion can be drawn regardless of the weighting applied. There was little variation in rankings according to pairwise and the five better performers included all section combinations which ranked within the first four in at least one of the pairwise rankings. This approach deleted the worst options, but ensured that any options which performed reasonably well according to at least one of the three applied weightings were given further consideration. The five section combinations are listed in **Table 7.2** and further described below.

**Table 7.2 Best Performing Tintenbar Options**

Section Combinations	C1	C1	C1	D1	D1
	B1	C2	B1	H1	D2
	A1		B2		
Unweighted Score	146	156	148	149	139
Rank out of 9	4	1	3	2	5
<b>Base Case</b>					
Project Team Weighted Score	3.60	3.87	3.64	3.99	3.77
Rank out of 9	6	2	4	1	3
<b>Sensitivity Tests</b>					
CLG Weighted Score	3.82	4.05	3.85	3.72	3.36
Rank out of 9	3	1	2	4	7
Agency Weighted Score	3.67	3.90	3.66	3.68	3.51
Rank out of 9	3	1	4	2	5

Route C1-C2 utilises the majority of the Ballina Bypass design north of Sandy Flat Road before diverting slightly to the west of the existing highway for the remaining section of this zone. Its benefits include good performance in terms of engineering and cost, as well as limited severance on residential and future residential areas.

Section combination D1-H1 also performed well in this zone. Section D1 follows a valley towards a saddle in the ridge line which Ross Lane follows to the east of the existing highway. On the north side of the saddle Section H1 is located close to the base of the escarpment, limiting the impact on flooding and also avoiding the worst of the soft soils in the coastal plain. Grades are relatively flat compared to plateau options and it would be raised above existing ground to provide flood immunity. There is generally less development on the coastal plain and this option would directly affect fewer dwellings and would require fewer service/access roads compared to plateau options.

The route option comprising Sections C1-B1-B2 follows the Ballina Bypass then follows the existing highway for about 1 km before diverting to the west.

The other two section combinations that performed reasonably well were C1-B1-A1 and D1-D2.

Options based on Section E1 (E1-E2 and E1-F1) performed poorly, as did options involving section L1 and I1 which follow on or close to the existing highway.

#### 7.4.2 Newrybar Zone – 18 options

The Newrybar Zone has the most sections and the most possible route options. It also proved to be the most complex to analyse because the performance of the section combinations varied significantly according to the pairwise that was applied.

In order to reduce the number of section combinations to a more manageable number, options which ranked within the top six in at least one of the pairwise rankings were considered to perform relatively well and were taken forward for further consideration. This allowed deletion of the worst options but ensured that any options which performed reasonably well according to at least one of the three applied weightings were given further consideration. The 18 shortlisted options are reduced in this way to eight best performing Newrybar zone options as presented in **Table 7.3**.

**Table 7.3 Best Performing Newrybar Options**

Section Combinations	A2	L2	B3	C3	H2	H2	K1	E3
	J1		B4	B4	H3	H3		
					A4	H4		
Unweighted Score	160	156	160	163	149	151	145	150
Rank out of 18	2	4	2	1	7	5	9	6
<b>Base Case</b>								
Project Team Weighted Score	4.05	3.83	3.92	4.08	3.81	3.84	3.95	4.03
Rank out of 18	2	7	5	1	8	6	4	3
<b>Sensitivity Tests</b>								
CLG Weighted Score	4.13	4.21	4.16	4.24	3.79	3.81	3.61	3.70
Rank out of 18	4	2	3	1	6	5	12	8
Agency Weighted Score	4.05	3.89	3.95	4.06	3.73	3.77	3.73	3.84
Rank out of 18	2	4	3	1	8	6	7	5

**Table 7.3** includes four section combinations located on the plateau for the full length: A2-J1, C3-B4, B3-B4 and L2. By staying close to the existing Pacific Highway, these plateau options tend to perform well regarding:

- Environmental constraints.
- Engineering constraints, such as length through soft soils and length through flood prone land.
- Constraints relating to the decrease in property value, such as relative noise burden and the acquisition of dwellings not currently within 200m of the existing highway.

Also included are four section combinations located, for at least part of the zone, on the coastal plain: H2-H3-H4, H2-H3-A4, K1 and E3. In the Sieve 1 analysis these options do not generally perform as well as the best plateau options, but they do provide links to the better performing section combinations in the Tintenbar and Bangalow zones.

#### 7.4.3 Bangalow Zone – 28 options

As noted at the start of **Section 7.4**, the Bangalow zone long list included three alignments that utilise a tunnel through St Helena Hill - A6, E6, and H7. Due to the similarity in selection criteria ratings of these sections, E6 was chosen as a typical alignment for the tunnel and tunnel approaches and this rationalised the 28 options into the 12 options shown in **Table 7.1**.

The number of section combinations was further reduced as before by selecting those section combinations which ranked within the top six in at least one of the pairwise rankings. Two exceptions were made as follows:

- Combination C6-E5-E6 was excluded because the only connecting option in the Newrybar Zone (section combination C3-C4-C5) performs poorly and was not selected for further consideration in that zone.
- Even though the analysis indicates that non-tunnel options performed relatively poorly, the best performing non-tunnel option (section combination L3-M1) has been retained for further consideration.

Excluding C6-E5-E6 but including the non-tunnel option L3-M1, the best performing Bangalow zone options are reduced from twelve to seven as shown in **Table 7.4**.

**Table 7.4 Best Performing Bangalow Options**

Section Combinations	J2	L3	L3	A5	K2	G2	E4
	E6	H6	M1	E6	E6	E6	E5
		E6					E6
Unweighted Score	152	150	145	159	155	152	155
Rank out of 12	4	7	9	1	2	4	2
<b>Base Case</b>							
Project Team Weighted Score	3.77	3.78	3.57	4.00	3.88	3.74	3.87
Rank out of 12	6	5	9	1	2	7	3
<b>Sensitivity Tests</b>							
CLG Weighted Score	3.90	3.89	3.78	4.07	3.98	3.91	3.94
Rank out of 12	5	6	8	1	2	4	3
Agency Weighted Score	3.82	3.82	3.72	4.04	4.00	3.79	3.99
Rank out of 12	5	6	8	1	2	7	3

It should be noted that application of the three pairwise weightings did not greatly affect the relative rating of section combinations in this zone.

One of the better performing section combinations in this zone was A5-E6. This section combination passes through the saddle where Tinderbox Road connects to Bangalow Road before passing across Tinderbox Creek to a tunnel under St Helena Hill.

Section combination K2-E6 similarly performed well. This section combination is a continuation of E3 or K1 which climb the escarpment in the Newrybar Zone, before passing through the same saddle at Tinderbox Road and again with a tunnel under St Helena Hill.

Section combinations J2-E6, L3-H6-E6 and E4-E5-E6 are also better performing options. L3-H6-E6 follows part of the Bangalow Bypass before crossing Bangalow Creek and following the Tinderbox Creek valley to the tunnel under St Helena Hill. J2-E6 has a flatter grade down to Bangalow Creek but would require a number of viaducts. Section combination E4-E5-E6 crosses Bangalow Creek and Tinderbox Creek further to the east before curving back to the tunnel under St Helena Hill.

These three options would pass through a tunnel under St Helena Hill. The tunnel in Section E6 would be 200 to 300 m long and the tunnel pavement would be about 40 m below the surface at the deepest point.

As described in **Section 6.3.3**, there are three options for the northern approaches to the tunnel. In each case the tunnel would be about the same length and the portals would be in about the same location. Each of the northern approach options could connect to any of the options on the south side of the tunnel, or to Section M1, however they rated similarly in the pairwise analysis and so were not included in the comparison table. An assessment of the three options for the northern approaches to the tunnel is included in **Section 7.5.2**.

As noted above, the section combination L3-M1 is included for consideration as a non-tunnel option despite its lower ranking. It follows part of the Bangalow Bypass but continues in a straight line where the existing bypass veers to the left up the hill. It continues towards the existing highway, joining an alignment very similar to the alignment of the Bangalow to St Helena EIS Option F. It passes through St Helena Hill in an open cutting approximately 35 m deep, and would require a viaduct structure about 500 m long across the lower land on the north side of the cutting.

## 7.5 Technical Review

The better performing options from each zone were assessed both qualitatively and quantitatively to assist in shortlisting the route options. The objectives in the shortlisting process were to facilitate the identification of a short list of route options that achieved the following:

- Performed well overall.
- Resulted in at least two route options through each zone - but limited the number of shortlisted options (for example, by not shortlisting similar options through the same area where one option is clearly better than the other).

Therefore it was not simply a matter of selecting the highest ranked options in each zone, since some options connected to relatively poor performing sections in adjacent zones.

**Figure 7.1** shows the better performing section combinations from the long list of route options, as derived in **Section 7.4**, and how they can be linked to options in adjacent zones.

By assessing the performance of section combinations initially within zones and then as combinations over two or more zones, the short list of route options can be derived as described in the following sections.

### 7.5.1 Tintenbar Zone

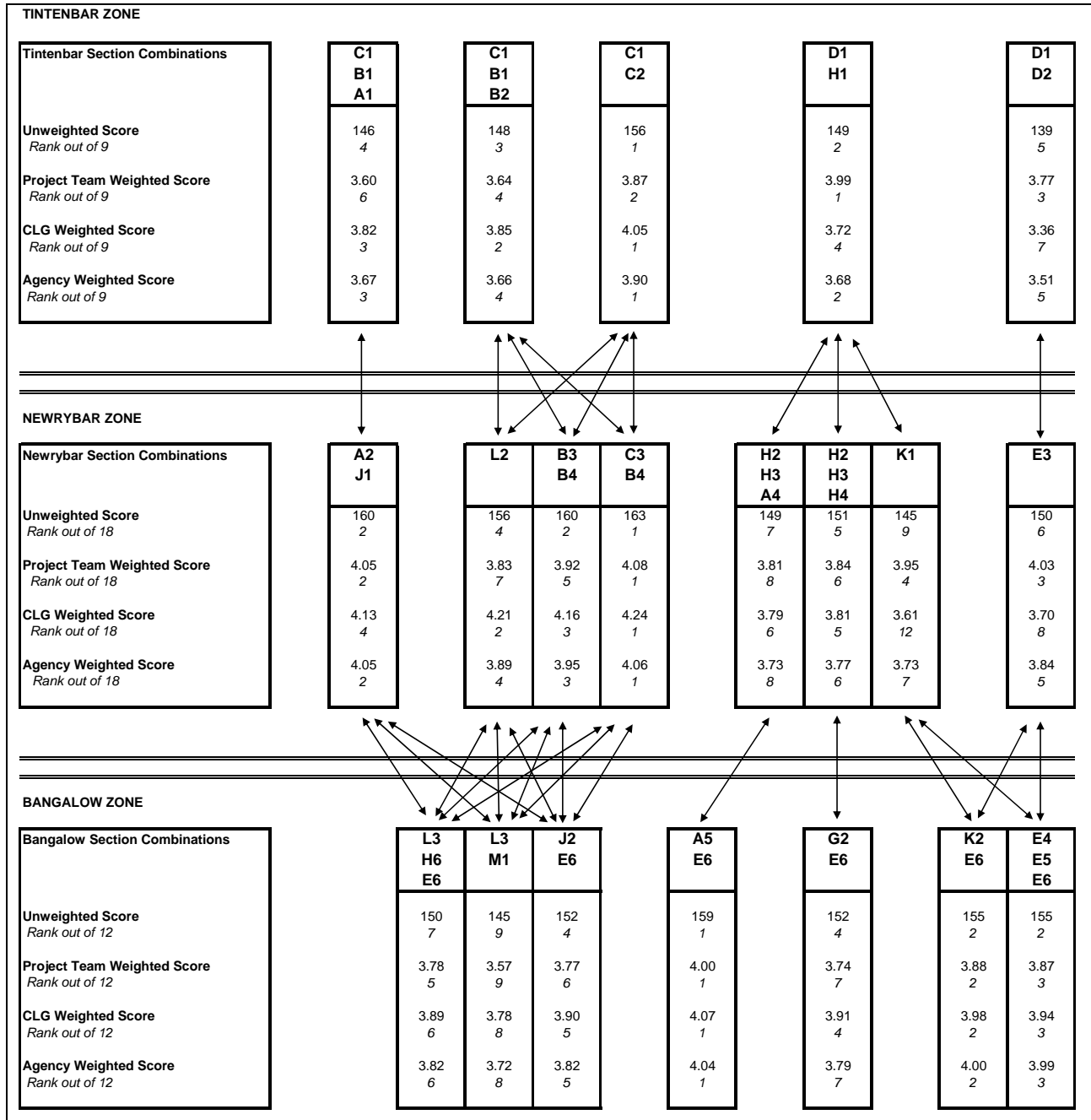
Within the Tintenbar zone, 3 of the 5 better performing options have been selected for shortlisting. Two options were not carried forward. Details are provided below:

- Option C1-C2 performs well and connects to good options in the Newrybar zone and has been included in the short list.
- Option D1-H1 performs well and connects to good options in the Newrybar zone and has been included in the short list.
- Option C1-B1-B2 has the advantage of allowing utilisation of the full length of the approved Ballina Bypass alignment (including the Ross Lane interchange), and also utilises the existing highway corridor in Section B1. However, Section B2 does not perform as well as Section C2. An adjustment has therefore been made in shortlisting this option by connecting B2 onto C2 where the two sections cross part way through (now Option C1-B1-B2/C2). This change would not significantly affect the rankings and has the advantage of moving the option further from Emigrant Creek Dam.
- Option D1-D2 is the second coastal plain option but does not perform nearly as well as Option D1-H1. It has not been included on the short list.

- Option C1-B1-A1 has not been shortlisted, primarily because there are two other shortlisted plateau options through this zone (C1-C2 and C1-B1-B2/C2) which perform better, and also because of concern about its proximity to Emigrant Creek Dam.

The shortlisted options from the Tintenbar zone are therefore Option C1-C2, Option D1-H1, and Option C1-B1-B2/C2.

**Figure 7.1 Better Performing Section Combinations**



### 7.5.2 Bangalow Zone

The next zone assessed was Bangalow, primarily because it is the other end zone and therefore influenced by options in one adjacent zone only.

There was remarkable consistency in the ranking of options within this zone with little variation when different weightings were applied.

- The best performing options within this zone were Option A5-E6, Option K2-E6 and Option E4-E5-E6. Options A5-E6 and K2-E6 have been shortlisted. Option E4-E5-E6 was not shortlisted because it begins and ends at the same nodes as shortlisted Option K2-E6, but was consistently ranked lower.
- The next options assessed were the three which commence at the Newrybar/Bangalow zone boundary where it crosses the existing highway. These options are L3-H6-E6 (follows the existing Bangalow bypass before diverting east up the Tinderbox Creek valley to the tunnel), Option J2-E6 (passes through the Tinderbox Road saddle before connecting to the tunnel approach), and Option L3-M1 (connects onto part of the old Bangalow to St Helena EIS Option F, avoiding the need for a tunnel). The first two options are ranked higher than Option L3-M1 regardless of the weighting applied (despite having a higher cost than the non-tunnel option). Option L3-H6-E6 and Option J2-E6 therefore have been shortlisted in preference to the non-tunnel Option L3-M1.
- Option G2-E6 had an overall ranking lower than the four shortlisted options and connects only to Option H2-H3-H4 which has a relatively low ranking in the Newrybar zone compared to the other options shown in the Newrybar Zone **Table 7.3**. On this basis, Option G2-E6 has not been shortlisted.

As described at the start of **Section 7.4** and in **Section 6.3.3**, three options for the northern approaches to the tunnel were included in the longlisted Bangalow zone options, E6, A6 and H7. To simplify the evaluation of the Bangalow zone, the shortlisting process for this zone as described above has been based on tunnel approach Option E6. A separate assessment has been carried out for the three northern approaches to determine which option(s) should be shortlisted. Assessment of the three tunnel approaches has been based on Section A5, the most highly rated southern approach to the tunnel. Using Section A5 as the common approach, the Sieve 1 process and pairwise has been applied to the three northern approach options:

- Section E6 which retains the 900 m of existing duplication that climbs at a 6% grade south from the Ewingsdale interchange, connecting to the south end of this duplication. At this point the grade reduces to 1.8% then increases to 4.4% as it climbs to the tunnel portal.
- Section A6 which is the same as E6 but maintains a steady 3% grade from the south end of the existing duplication.
- Section H7 which would involve reconstruction all the way from the Ewingsdale Interchange at a flatter 4.4% grade, on an alignment slightly closer to Ewingsdale.

The results of applying the evaluation criteria and pairwise to the three northern approaches to the tunnel are shown in **Table 7.5**.

The results indicate that the choice of northern tunnel approach does not have a major effect on the unweighted or weighted scores. Had Sections A5 and K2 been combined with Sections A6 or H7 rather than E6, Sections A5 and K2 would still have been shortlisted as the better performing Bangalow zone options.

In terms of selecting which northern approach options should be selected for the short list, application of the Sieve 1 criteria and pairwise has not identified any major differences between the three options. Sections E6 and A6 have the same horizontal geometry and the differences in vertical grading are small. It is proposed to shortlist Section E6 with the intention of reviewing the vertical geometry during the refinement of the short list of options in the next stage of design development.

**Table 7.5 Comparison of Bangalow Options for Northern Approach to Tunnel**

Section Combinations	A5	A5	A5
	E6	A6	H7
Unweighted Score	159	158	158
Rank out of 3	1	2	2
<b>Base Case</b>			
Project Team Weighted Score	4.00	3.93	3.94
Rank out of 3	1	3	2
<b>Sensitivity Tests</b>			
CLG Weighted Score	4.07	4.04	4.02
Rank out of 3	1	2	3
Agency Weighted Score	4.04	4.00	3.98
Rank out of 3	1	2	3

Even though Option H7 is slightly closer to Ewingsdale, it is proposed that this option be shortlisted for the following reasons:

- The flatter grades of Option H7 are considered to have the potential to reduce noise levels from southbound climbing vehicles as well as reducing compression braking for northbound trucks.
- Option H7 would allow the existing highway to be retained for local traffic.

The shortlisted options from the Bangalow zone are therefore Option A5-E6, Option K2-E6, Option L3-H6-E6 and Option J2-E6, which connect to northern approach section E6 and Option A5-H7, Option K2-H7, Option L3-H6-H7 and Option J2-H7 which connect to northern approach section H7.

### 7.5.3 Newrybar Zone

Determination of the shortlisted options within this zone was more difficult because of the number of options and the fact that there were significant variations in ranking depending on the pairwise applied. The selection process was assisted by reference to the shortlisted options in adjacent sections.

- Option C3-B4 performs well, connects to good options in both the Tintenbar and Bangalow zones, and has been shortlisted.
- Other plateau options under consideration were Option L2, Option B3-B4 and Option A2-J1. Option A2-J1 is the western most option and was eliminated because it only connects to Tintenbar option C1-B1-A1 which was not highly ranked compared to other Tintenbar options and was not shortlisted in the Tintenbar zone. Option L2 (on-line existing highway option) and Option B3-B4 (generally just to the east of the existing highway) had similar rankings and the same connectivity to adjacent sections. It was decided to shortlist Option L2, primarily because, together with the shortlisted on-line options in adjacent zones (Tintenbar C1-B1-B2/C2 and Bangalow L3-H6), it would allow a full assessment of the on-line upgrade option.
- Four coastal plain options (H2-H3-A4, H2-H3-H4, K1 and E3) were considered and none of the coastal plain options stands out as clearly better than others. The decision on which coastal plain option(s) to shortlist was therefore made by referring to the performance of connecting options in adjacent zones.
  - Option H2-H3-A4, while not a good performer in isolation, connects to highly ranked shortlisted options in both the Tintenbar zone (Option D1-H1) and Bangalow zone (Option A5-E6) and has therefore been shortlisted.

- Option K1, while not as good in isolation, connects to good options in both the Tintenbar zone (Option D1-H1) and Bangalow zone (Option K2-E6) and has therefore been shortlisted.
- Option E3 connects only to Option D1-D2 in Tintenbar zone which did not perform nearly as well as D1-H1 and was not shortlisted. Therefore Option E3 has not been shortlisted in this section.
- Option H2-H3-H4 connects only to Option G2-E6 in Bangalow zone which did not perform as well comparatively as other Bangalow zone options and was not shortlisted. Therefore Option H2-H3-H4 has not been shortlisted in this section.

Concern has been expressed about geotechnical issues where Option H2-H3-A4 climbs the escarpment (Section H2) traversing it as a side slope. Option K1 utilises a spur line to climb the escarpment and geotechnical issues would be less significant. Inclusion of coastal plain Option K1 ensures that an alternative coastal plain option is available should difficulties arise with other route options.

The shortlisted options from the Newrybar zone are therefore Option L2, Option C3-B4, Option H2-H3-A4, and Option K1.

#### 7.5.4 Confirmation of Short List of Route Options

The final step of the Sieve 1 evaluation was to combine the short list of options in each zone into corridor options over the full length from north to south and to renumber the routes for simplicity.

**Figure 7.2** graphically displays the sections which make up the short list of options. The shortlisted options were renamed Option A, Option B, Option C and Option D to simplify the identification of the options for public display and further assessment. Option A incorporates an upgrade following the general alignment of the existing corridor, Option B is a plateau option in an entirely new corridor and Options C and D are partly located on the eastern coastal plain. The new names for the short list are provided in **Table 7.6** which also shows the long list sections that were combined to form the short list.

##### 7.5.4.1 Option B Modified from the Bangalow to St Helena EIS

Options involving an upgrade of the existing highway (Sections L3-L4 and H5-L4) were included in the long list of options for the Bangalow zone. As noted in **Chapter 1**, recommendations from the Northern Pacific Highway Noise Taskforce (RTA2003) were the catalyst for further review of Option B from the Bangalow to St Helena EIS. Section L4 incorporates Option B Modified from the Bangalow to St Helena EIS. The assessment results in **Table 7.1** show that the two options with Section L4 were rated lowest of the Bangalow zone options regardless of the weighting applied. **Table 7.1** also shows that there was a considerable margin between the unweighted and weighted scores of L3-L4 and H5-L4 and the unweighted and weighted scores of the other ten longlisted Bangalow zone options.

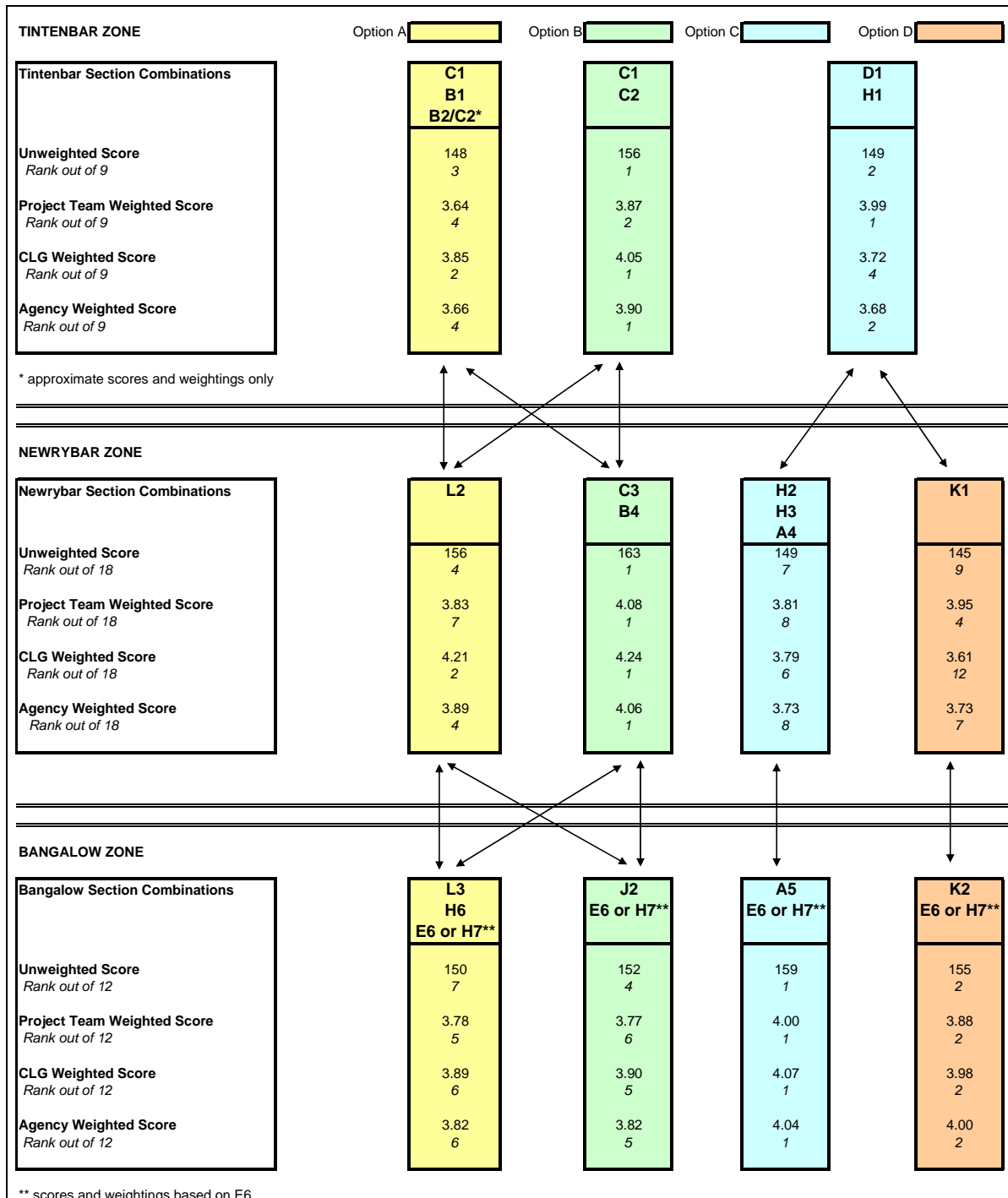
Particular issues which contributed to the relatively poor ranking of options incorporating Section L4 (Option B Modified) were:

- It does not meet the highway design criteria established for the upgrade. In particular the design speed of 80 km/h and the sustained 8% grade on the escarpment are considerably below the adopted design standard and would be inconsistent with the standards of adjoining sections of the highway.
- It would force local traffic to share the upgraded highway, as it would not be possible to retain the existing highway as a separate road for local traffic usage. Intermediate interchanges would be required at Possum Creek Road and at Fowlers Lane/Coolamon Scenic Drive, in addition to the existing interchange providing access to Bangalow. The design would also include an at-grade intersection at St Helena Road. The additional interchanges and the greater mixing of local and through traffic with this option would be inconsistent with the standards of adjoining sections of the highway.
- It would be between 1.2 km and 1.8 km longer than other shortlisted route options, adding to travel times for all users.

- It performed poorly in terms of noise impacts and would require acquisition of a greater number of dwellings.
- It crosses more wildlife corridors than other options.

For these reasons neither of the two Bangalow options incorporating Section L4 (Option B Modified) was included in the best performing Bangalow zone options taken forward for further consideration, and neither option made the shortlist.

**Figure 7.2 Sections Making up Short List of Route Options**



#### 7.5.4.2 Other Non-Tunnel Options

Apart from Section L4, the only other non-tunnel section included in the longlisted options for Bangalow zone was Section M1. Section M1 joins an alignment very similar to the alignment of the Bangalow to St Helena EIS Option F. It passes through St Helena Hill in an open cutting approximately 35 m deep, and would require a viaduct structure about 500 m long across the lower land on the north side of the cutting.

The two options incorporating M1 were not included in the best performing Bangalow zone options taken forward for further consideration. The assessment results in **Table 7.1** show that the two options with Section M1 performed relatively poorly regardless of the weighting applied. Of the twelve Bangalow zone options shown in **Table 7.1**, the only options assessed as worse than the options with M1 were the two options incorporating Section L4 that followed the existing highway. The other eight options, all of which incorporated a tunnel under St Helena Hill, were generally assessed as performing better than options incorporating M1. The only exception was using the Agency weightings – in this instance, Option H5-M1 was rated marginally ahead of Option H5-H6-E6. This is not significant because Option H5-H6-E6 was not included in the best performing Bangalow zone options and was not shortlisted. Cost/engineering was the only selection criteria category where the M1 options rated better than the best performing options. In other respects, particularly in terms of safety and loss of agricultural land, the M1 options generally rated worse than the best performing options. Because of the relatively poor rated performance of the M1 options, they were not shortlisted.

**Table 7.6 Final Short List of Route Option Sections**

Short List Section Names	Combined from Long List Section Names
A/B	C1
A1	B1-B2/C2-L2
A2	L3-H6
B1	C2-C3-B4
B2	J2
C/D	D1-H1
C1	H2-H3-A4-A5
D1	K1-K2
T1	E6
T2	H7