EVANS & PECK

10 December 2012

Hon Duncan Gay
Office of the Minister of Roads and Ports
Governor Macquarie Tower
Level 35, 1 Farrer Place
SYDNEY NSW 2000

Pacific Highway at Wyong. Independent Evaluation of Upgrade Options

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Dear Minister

Following the presentation to stakeholders on 31 October 2012 of findings from our report, and the receipt of submissions and comments from the community and stakeholders, we submit our final report for the Independent Evaluation of Upgrade Options for the Pacific Highway at Wyong.

This final report is provided to the NSW Government in accordance with the RMS Terms of Reference dated April 2012 and your media release dated 31 January 2012. This final report will be provided to RMS for posting on their web site.

We thank you for the opportunity to prepare this report for the NSW Government.

Yours faithfully

Michael Moore
Principal
EVANS & PECK GROUP PTY LTD

Copy to Jai Reddy
Roads and Maritime Services
Woy Woy

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EVANS & PECK
think through the future

Roads and Maritime Services

Pacific Highway at Wyong

Independent Evaluation of Upgrade Options

7 December 2012

ISBN: 978-922041-57-9
RMS: 12.452

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1 Executive Summary

1.1 The Project

In 2002, the RMS (formerly the Roads and Traffic Authority) initiated a corridor route selection study, under the *Central Coast Transport Action Plan* to establish a preferred corridor for the Pacific Highway upgrade in Wyong. Generally the upgrade would provide four traffic lanes on either single or divided carriageways for the Pacific Highway from Tuggerah to Wadalba. The project was developed to a stage where three corridor options (comprising two bypass options and a through-town option) and five through-town alternatives were considered. The corridor options were evaluated for advantages and disadvantages, and a qualitative comparison of the through-town alternatives followed.

The strategic corridor options together with broad estimates of cost, and proposed advantages and disadvantages were announced in October 2006. At this time RMS announced the Eastern and Western corridor options were not considered feasible for reasons of low traffic volumes expected to use the corridors, social impact, environmental impacts, high cost and low benefits to the road user. In response to stakeholder input, RMS then proposed that for the Central Corridor, in particular at the town centre, five through-town alternatives were worthy of further investigation.

A preferred option was displayed in 2011, being to widen the existing highway through the town, providing two lanes in each direction, upgrading the intersections and provide limited parking. A period of community feedback was initiated with comments currently under consideration. A submissions report is due later this year.

The Minister for Roads and Ports announced on 31 January 2012 that the cost estimates previously produced by RMS for all bypass and through-town options for the upgrade would be independently evaluated. The principal objective of the evaluation was to review the cost estimates prepared for the various bypass and through-town options.

In June 2012 RMS appointed Evans & Peck to undertake an independent evaluation of the options.

1.2 Terms of Reference

Roads and Maritime Services (RMS) engaged Evans & Peck Pty Ltd (Evans & Peck) to independently review the cost estimates produced by RMS for the various through-town and bypass options for the future Pacific Highway upgrade at Wyong. The review was to:

- Provide independent estimates of cost for two bypass options displayed in 2006;
- Provide independent estimates of cost for five through-town options displayed in 2008;
- Provide independent estimate of cost for the preferred through-town option displayed in 2011;
- Ratify or otherwise the advantages and disadvantages for each of the three corridor options investigated up to 2006;
- Ratify or otherwise the qualitative comparison between the five through-town options investigated up to 2008 against the following criteria:
- Review the Road User Benefit-Cost analysis undertaken to date by RMS.

The deliverables required from this review are:

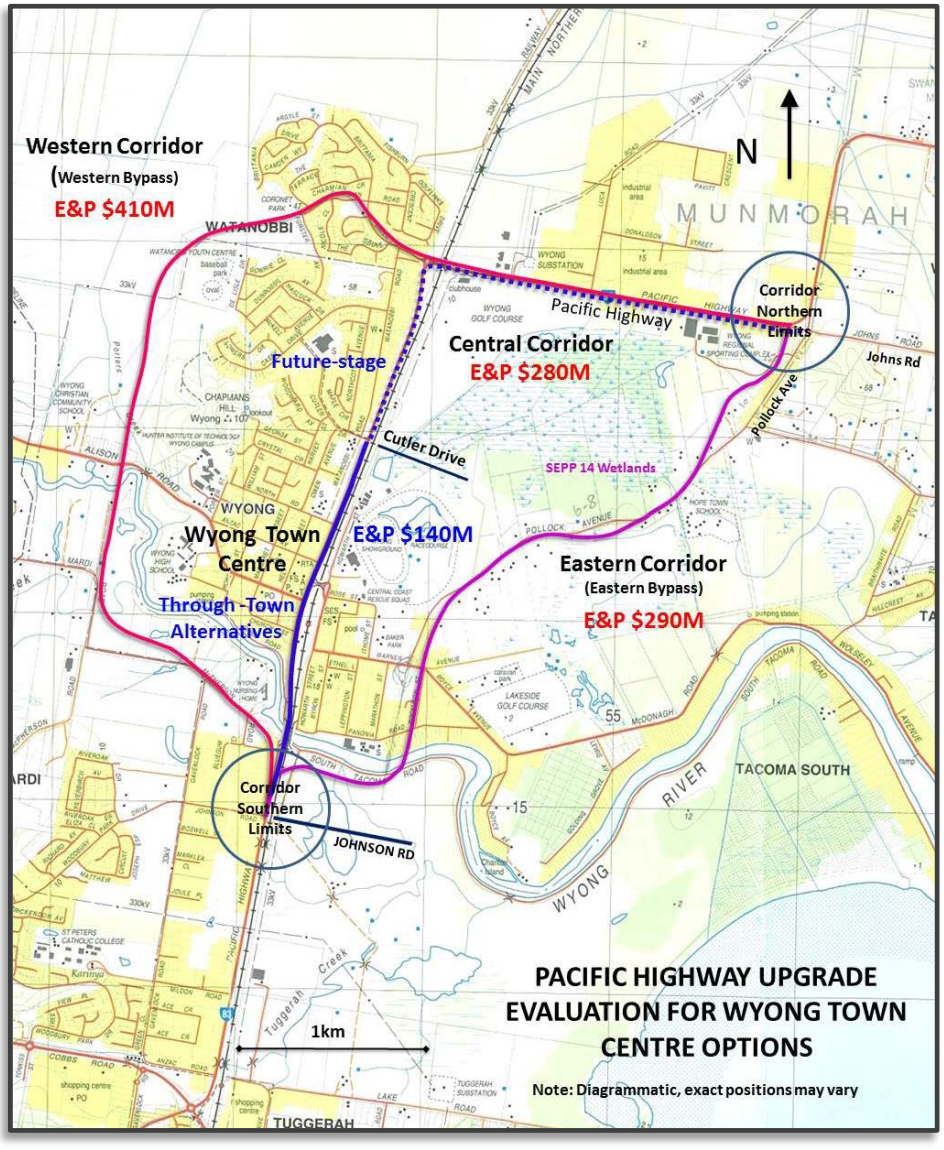
(a) A detailed report on each cost estimate for the through-town and bypass options, highlighting the differences found from the initial (RMS) cost estimates with reasons for those differences where possible;

(b) Monthly progress reports distributed to selected stakeholders; and

(c) Provision of the report and findings to Government for consideration.

1.3 Cost Estimates

Evans & Peck prepared cost estimates for two strategic bypass options, the Eastern and Western Corridors, based on the scope described in the *Options Study, October 2006*, the *Options Study – Community Update, October 2006,* and the RMS corridor alignment diagrams dated May 2006. To complement the two bypass options, Evans & Peck also prepared a third estimate for the Central Corridor option which completes the strategic overview with respect to the cost of bypass alternatives, and provides a point of reference to consider the advantages and disadvantages of each of the three corridor options investigated.



Together the Eastern, Western and Central corridors form the three strategic upgrade options investigated for the Pacific Highway at Wyong between Johnson Road, Tuggerah and Johns Road, Wadalba.

Evans & Peck also prepared cost estimates for the five through-town alternatives for the Central Corridor option as listed in the *Options Report, July 2008*, covering the 2.1 km upgrade between Johnson Road and Cutler Drive. Evans & Peck included a further cost estimate for the RMS preferred through-town option, a revised widening of the existing carriageway as displayed in the *Community Update, November 2011.*

Evans & Peck's cost estimates for the strategic corridor options (2006), the through-town alternatives (2008), and the preferred Widened Carriageway (2011) are summarised below in Table 1. For comparison purposes, Table 1 also provides cost estimates for the through-town alternatives and preferred option adjusted to include highway upgrading over the entire 5.1 km length of the Central Corridor.

Table 1: Evans & Peck Cost Estimate Summary

Evans & Peck's Cost Estimate		Estimated Cost ($m)	Adjusted Cost ($m)[3]
Strategic Corridor Options 2006 [1]	Eastern Bypass (4.5km)	290	
	Western Bypass (6.9km)	410	
	Central Corridor (5.1km)	280	
Through-Town Alternatives (Central Corridor) 2008 [2]	Tunnel	360	500
	Land Bridge	150	280
	Howarth St	190	330
	Widened Carriageway	140	280
	Split-Level Carriageway	140	280
RMS Preferred Option 2011 [2]	Revised Widened Carriageway	140	280

Notes:

1. Strategic Corridor Option estimates include scope from Johnson Road, Tuggerah to Johns Road, Wadalba.
2. Through-Town Alternative estimates include scope from Johnson Road, Tuggerah to Cutler Drive, Wyong (2.1km).
3. Cost estimates adjusted for the entire 5.1km Central Corridor length, Johnson Rd, Tuggerah to Johns Rd, Wadalba
4. All amounts are in $ (2012) terms.
5. Cost estimates have been rounded to the nearest $10m.

The cost estimate summary indicates that the Western Corridor ranks highest cost. The Western Corridor is significantly longer, requires more property to be acquired and has potentially greater impact on public utilities. The cost estimates for the Eastern and Central Corridor options are within 5% and at a strategic level, these estimates can be considered similar.

Of the through-town alternatives, the Tunnel and Howarth Street options rank highest cost and do not provide the road user benefits of the other alternatives. The Land bridge alternative ranks marginally higher cost than the Widened and Split-Level Carriageway alternatives however, like the Tunnel, does not provide the road user benefits of the other alternatives. At this strategic level, the estimates for the Widened and Split-level Carriageway options rank equal lowest cost.

1.4 RMS Cost Estimates - Variance

To undertake a comparison of RMS and Evans & Peck estimates, a cost escalation factor was applied to the RMS estimates to adjust to current pricing, and the Evans & Peck estimates for the five through-town alternatives were scope adjusted to include the full length of the Central Corridor, similar to the RMS estimates. The 2.1km preferred option is the only RMS estimate available to correspond directly to the scope of the Evans & Peck estimates required under the Terms of Reference.

The differences in total project cost between the RMS and Evans & Peck cost estimates are provided in Table 2.

Table 2: Comparison of Estimates

Cost Estimate		RMS $2012 ($m)	E&P ($m)	E&P Adjusted ($m) [1]	Difference ($m)	Difference %
Strategic Corridor Options 2006	Eastern Bypass	264	290		+26	+10%
	Western Bypass	418	410		-8	-2%
	Central Corridor[3]	-	280		-	-
Through-Town Alternatives (Central Corridor) 2008	Tunnel	550		500	- 50	-9%
	Land Bridge	280		280	0	0%
	Howarth St	329		330	+1	+0%
	Widened Carriageway[2, 4]	-		280	-	-
	Split-Level Carriageway	196		280	+84	+43%
RMS Preferred Option 2011	Widened Carriageway[2]	155	140		-15	-10%

Notes:

1. Cost adjusted for comparison of route length of 5.1km from Johnson Road, Tuggerah to Johns Road, Wadalba - from Table 1.
2. The Widened Carriageway scope is from Johnson Road, Tuggerah to Cutler Drive.
3. Central Corridor not priced by RMS
4. RMS estimate for Widened Carriageway 2008 not available.
5. All amounts are in $(2012)

At this high level comparison, the variance between the RMS and Evans & Peck estimates is within 10% for six of the seven cost estimates, with only the Split-Level Carriageway option indicating significant variance of 43%. However the RMS estimate for the Split-Level alternative is considered unreliable and the actual variance is much less. The ranking of corridor options appears similar with the Western Corridor the highest cost. The ranking of the through-town options also appears similar with the tunnel option the highest cost. For the RMS preferred option, the difference in estimates is less than 10% after adjusting for errors identified.

The RMS estimates have included higher contingency allowances where project scope is not well defined, while Evans & Peck has endeavoured to define scope to the extent possible and adopt lower contingency provisions.

1.5 Corridor Options 2006

The strategic corridor options Eastern, Western and Central Corridors were identified in the *Options Study – October 2006.* Evans & Peck's approach to ratifying the advantages and disadvantages documented by RMS for each of the corridor options has been to provide a position in regard to the statements made, as either:

(a) agreement;

(b) qualified agreement;

(c) disagreement; or

(d) advise where there is insufficient information to form a view.

1.5.1 Eastern Corridor

For the Eastern Corridor, Evans & Peck broadly agrees with 50% of the RMS assessment.

Evans & Peck agrees the Eastern Corridor would impact on sensitive environmental protection zones, there are potential impacts on flora and fauna, that the corridor could have a dividing effect, and that heritage buildings in Wyong town centre would not be affected. There is also agreement on the need to acquire property (albeit qualified) and on the increase in road traffic noise levels where there is currently little noise.

There is insufficient information to form a view in regard to potential indigenous heritage impacts and whether an upgrade through the town centre will be required within 15 years.

At strategic estimate level the Eastern Corridor ranks equal lowest cost, and accordingly Evans & Peck is not in a position to agree definitively that an Eastern Corridor is the second most expensive option.

1.5.2 Western Corridor

Evans & Peck broadly agrees with more than 60% of the RMS assessment for the Western Corridor.

Evans & Peck agrees the Western Corridor has potential to impact on flora and fauna, that east-west traffic volumes through Wyong would likely increase, that the corridor would have a dividing effect, and that heritage buildings in Wyong town centre would be unaffected. There is also agreement on the need to acquire property (albeit qualified), on the increase in road traffic noise levels where there is currently little noise, and on the potential impacts on the Wyong River flood plain.

There is insufficient information for Evans & Peck to form a view in regard to potential indigenous heritage impacts, whether an upgrade through the town centre will be required within 10 to 15 years, and whether a new Link to the F3 Freeway has potential.

From comparisons of all estimates, the Western Corridor ranks highest cost, and accordingly Evans & Peck agrees that a Western Corridor is the most expensive option.

1.5.3 Central Corridor

Evans & Peck agrees with most of the RMS assessment for the Central Corridor.

Evans & Peck agrees the Central Corridor will make good use of existing infrastructure, property acquisition will be minimised, additional noise levels will not be transferred to existing residential areas, and there should be no impact on environmental protection zones and floodplains. Evans & Peck also agree parking in the town centre would be reduced, and as a minimum there will be a visual impact on the heritage buildings including an effect on their context.

At strategic estimate level the Central Corridor ranks equal lowest cost and accordingly Evans & Peck is not in a position to agree definitively that a Central Corridor is, on its own, the least expensive option.

1.6 Qualitative Comparison 2008

The qualitative comparison of the five through-town options investigated by RMS up to 2008 is documented in the *Options Study Report, July* 2008. Evans & Peck has provided commentary on the RMS comparison in Section 6 of the report, indicating agreement or disagreement with the RMS assessment as appropriate by specific reference to the supporting technical investigations where available.

Evans & Peck generally agrees with the qualitative comparisons by RMS against each of the assessment criteria, with the exception of ratings given for the heritage listed buildings criteria. The close proximity of the proposed road upgrade to the heritage buildings at Church Street will have a negative impact, the cost to modify or relocate the buildings will be high, and road design standards may be compromised. Evans & Peck recommend any proposal that retains these buildings in their current position should be confirmed with rigorous design assessment and road safety audit.

Considering the overall assessment, the Tunnel and Howarth Street alternatives are high cost and, together with the Land Bridge alternative, pose significant construction complexity and do not achieve the road user benefits of the Widened Carriageway or Split-Level Carriageway alternatives.

The Widened Carriageway and Split-Level Carriageway alternatives rank lowest cost and the traffic benefit of each is dependent on the configuration of intersections, allowable turning movements and pedestrian crossing opportunities. The Widened Carriageway ranks lowest impact on retail trade criteria ahead of the Split-Level alternative, and the Widened Carriageway outperforms the Split-Level Carriageway on loss of car parking. Both these alternatives involve moderate construction challenges and issues.

Internal approval to implement any non-conforming road geometry for the RMS preferred option adjacent to or near the heritage buildings, is recommended before any further analysis of traffic models or cost estimating is progressed.

1.7 Road User Benefit

The Road User Benefit analysis provided by RMS for this review represents the RMS preferred through-town option using input capital cost from the RMS 2011 Cost Estimate for work between

Johnson Road and Cutler Drive (2.1 km). This analysis was undertaken for the Central Corridor option only. This review of the Road User Benefit analysis, considers the results against the requirements in the RMS Economic Analysis Manual.

Evans & Peck notes the analysis provides a clear indication that investment in the project is worthy of consideration. The range for Benefit Cost Ratio, calculated across a range of sensitivities, is between 6.7 and 20. The Net Present Value is in excess of $635 million and the range of First Year Rate of Return is between 25% and 50%. The results of the analysis appear favourable.

Other observations from the review are:

- The data and information to support the analysis is incomplete;
- The key assumptions are not defined;
- The analysis appears to comply with RMS guidelines in the Economic Analysis manual, however the process for economic evaluation has not been applied in its entirety; and
- The analysis is limited to the RMS preferred option, with no comparison against other project options or alternatives.

1.8 Recommendations

To improve the certainty of the RMS cost estimates and validate the RMS evaluation of options, Evans & Peck offer the following recommendations:

1. Further investigation is undertaken to refine the scope and validate the feasibility of the concept designs, in particular the concept design for the Eastern Corridor;
2. Further investigation is undertaken to update the traffic models that predict the distribution and volumes of traffic;
3. Further investigation is undertaken to validate the impact on property and cost of acquisition, in particular for the Eastern Corridor, as this is a significant contributor to total project cost;
4. Further investigation is undertaken to validate the extent of environmental impacts associated with the proposals, in particular the Eastern Corridor;
5. Upon validation of the scope and predicted traffic, update the detailed estimates to confirm the lowest cost outcome from the corridor selection study;
6. Prepare a Project Appraisal Report comparing the road user benefits and costs for the preferred option(s); and
7. Complete a comprehensive risk analysis and quantitative risk assessment of the preferred option.

2 Introduction

2.1 Project Overview

The Pacific Highway through Wyong forms part of the NSW State Road Network in the Wyong Local Government area. It is a major transport corridor linking the areas around Gosford with areas further north such as eastern and southern Lake Macquarie as well as providing access to locations along the east coast from Woy Woy in the south to Swansea in the north. Prior to opening new sections of the F3 Freeway to the west of Wyong, the highway was the main route for traffic travelling between Sydney and Newcastle. Currently, the section of highway through Wyong provides for a high proportion of through traffic as well as local traffic travelling to the commercial precincts in and around Wyong.

In 2002, the RMS (RMS) formally the Roads and Traffic Authority (RTA) initiated a corridor route selection study, under the Central Coast Transport Action Plan, which would establish a preferred corridor for the Pacific Highway in Wyong thereby allowing informed planning and development for areas in and around Wyong. Three potential corridors from Johnson Road in the south to Johns Road Wadalba in the north were investigated. The three corridors identified were an East Corridor crossing the railway line south of the Wyong River and passing through East Wyong, a Central Corridor using the existing highway and a West Corridor crossing the Wyong River and Alison Road west of the high school and passing through Watanobbi and on to Wadalba.

Figure 1: Strategic Bypass Options

The strategic corridor options together with broad estimates of cost, proposed advantages and disadvantages were announced in October 2006. The East and West corridor options were not feasible for reasons of low traffic volumes that would be attracted to the corridors, social impact, environmental impacts and high cost and low benefits to the road user. RMS then proposed that for the Central Corridor, in particular at the town centre there could be five alternatives worthy of further investigation, these being:

- A Tunnel under the existing highway;
- A Land Bridge along the existing highway alignment;
- The southbound carriageway crossing the railway line to use Howarth Street then crossing back again to join the existing highway just north of the Wyong River;
- A Widened Carriageway along the existing highway alignment to provide two lanes in each direction; and
- A Split-Level Carriageway on the existing highway alignment.

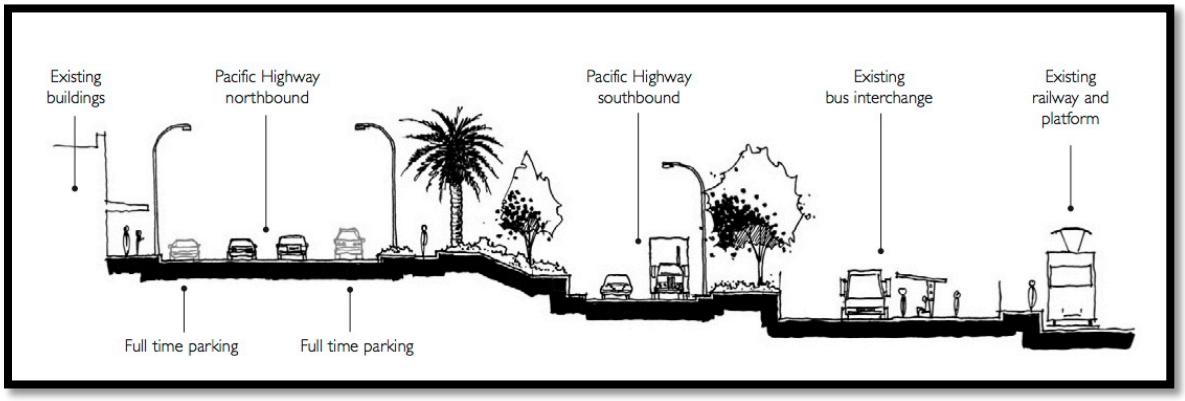


Figure 2: Cross Section Split-Level Carriageway

RMS announced in July 2008 the preferred highway upgrade option would be to widen the existing carriageway. The preferred option was displayed again in November 2011 with minor changes. A period of community feedback was initiated with comments currently under consideration. The report is due later this year.

The Minister for Roads and Ports announced 31 January 2012 that the cost estimates previously produced by RMS for all bypass and through-town options for the future upgrade of the Pacific Highway at Wyong would be independently evaluated. In June 2012 Evans & Peck (E&P) were appointed to undertake the independent evaluation. The principal objective was to review the cost estimates prepared for the various through-town and bypass options. The Terms of Reference also required examination of the advantages and disadvantages proposed in support of the Central Corridor options investigated up to 2006 together with examination of the qualitative comparative assessments made between the Central Corridor alternatives reported in 2008.

2.2 Terms of Reference

2.2.1 Objectives

The principal objective of the evaluation is to independently review the estimates of cost produced by RMS for the various through-town and bypass options for the future upgrade of the Pacific Highway at Wyong.

2.2.2 Background

This evaluation is a result of community concerns expressed in regard to the preferred option displayed by RMS on 23 November 2011. (The preferred option was a Central Corridor option with a widened existing highway alternative as described in the *Community Update, Revised Preferred Option - November 2011)*. This review fulfils an election commitment made in March 2011.

2.2.3 Scope

The scope of this evaluation is as follows:

- Provide independent estimates of cost for the two bypass options displayed in 2006;
- Provide independent estimates of cost for the five through-town options displayed in 2008;
- Provide independent estimate of cost for the single revised preferred through-town options displayed in 2011-2012;
- In undertaking the above, ratify or otherwise the advantages and disadvantages for each of the three corridor options investigated up to 2006;
- In undertaking the above, ratify or otherwise the qualitative comparison of the five through-town options investigated up to 2008 against the following criteria:
  - Retail trade (e.g. maintaining access during construction)
  - Heritage items (e.g. Cost to avoid and or minimise)
  - Traffic capacity (network implications)
  - Vehicle and pedestrian access (connectivity, severance)
  - Car parking within the town centre
  - Ease of construction (staging complexity, duration, impacts)
- Review the Road User Benefit-Cost analysis undertaken to date by RMS.

2.2.4 Output

The output required is a detailed report on each of the cost estimates for each of the through-town and bypass options, highlighting the differences found from the initial estimates of cost with reasons for those differences where possible.

Monthly progress reports are to be distributed to the stakeholders and published on the RMS website. The report and findings will be provided to Government for consideration.

2.3 Approach

Evans & Peck has undertaken the review in accordance with the Terms of Reference through a series of planned stages as shown in Figure 3 and comprising the key activities described below.

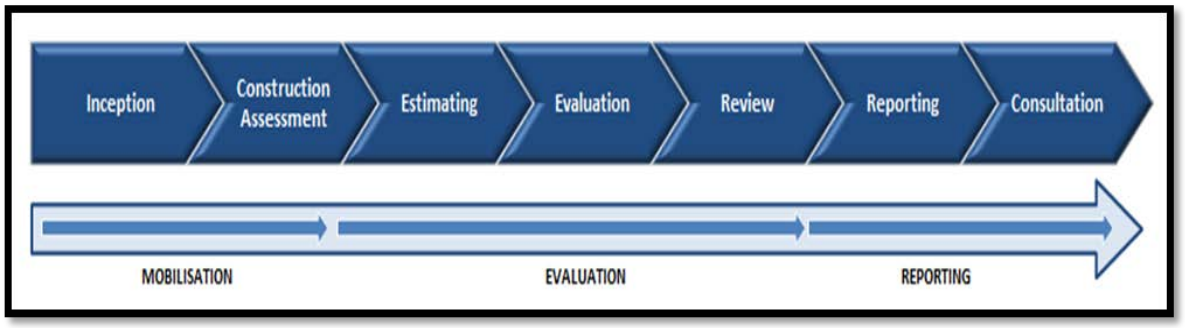


Figure 3: Evaluation Process - Stages

2.3.1 Inception

Initial briefing with RMS (held 8 June 2012) to confirm expected outcomes, deliverables and program followed by a site inspection and review of the RMS documents provided with the Terms of Reference.

2.3.2 Construction Assessment

From the documents provided, establish the scope of each Strategic Corridor Option and each Central Corridor Alternative. In this stage undertake a gap analysis between the information provided and that required to meet the objectives of the evaluation.

Upon finalising the scope, identify and evaluate:

- the order of works;
- significant project issues or site constraints;
- staging and constructability of individual sections of work;
- major items of temporary work;
- strategic level program for delivery of each option; and
- assumptions to be documented.

2.3.3 Estimating

Each cost estimate was prepared on the basis of the scope defined in the construction assessment stage. Adopting the RMS Estimating Manual guidelines the Total Project Cost for each project phase was broken down to Concept Development, Investigation and Design, Public Utilities, Property Acquisitions, Construction and Project Finalisation.

Separate amounts are estimated for contract or consultant work packages involved in the delivery of the various project phases together with amounts set aside for project management and client representation.

The assumed method of project delivery was traditional owner development with design by external consultants and a construct only contract delivery. Public Utility adjustments were assumed to be included in the construction contract. The owner manages property acquisition with consultant assistance.

Contingency amounts were developed by qualitative evaluation based on the amount of detail available and level of confidence in the estimate, within the guidelines of the RMS Estimating Manual.

2.3.4 Evaluation

The method adopted to ratify or otherwise the advantages, disadvantages and qualitative comparison was:

- Understand the issues, constraints, history and data provided in the technical reports issued to substantiate statements, conclusions and recommendations made by RMS in 2006 for Corridor Options and 2008 for through-town alternatives;
- Clarify the scope for each corridor option and through-town alternative;
- Clarify the key impacts, opportunities and risks Identified by RMS to differentiate options;
- Develop independent estimates;
- Review the RMS technical investigations and the data provided in support of previous RMS conclusions;
- Ratify or otherwise the statements made against the criteria used and comment where necessary; and
- Evaluate the RMS advantages, disadvantages and qualitative comparisons for gaps and omissions, and where further study is required.

2.3.5 Review

Peer review of the independent evaluation process and outcomes by the Evans & Peck project team included:

- ensuring all assumptions are accurately reflected in the independent estimates;
- ensuring key differences from RMS estimates are clearly identified and explained where possible;
- review of E&P's evaluation outputs, ensuring comments and assessments are accurate and supported; and
- review of recommendations for further investigation if needed.

2.3.6 Reporting

Provide monthly updates by way of a progress report to the stakeholders of the independent evaluation process identifying significant items of work under way together with status of the final report preparation.

2.3.7 Consultation

During this independent review Evans & Peck has engaged with stakeholders as follows:

- Issued monthly progress reports to major stakeholders on the status of estimate and report preparations;
- Presentation of draft report findings to stakeholders in October 2012; and
- Collated and documented stakeholder submissions in the final report.

2.4 Information Relied Upon

This evaluation is reliant on the project documentation provided by RMS and the information generated as an outcome of the evaluation. A list of documents supplied by RMS is included in Appendix 11. In summary the information relied upon includes:

2.4.1 RMS

RMS supplied the following information.

- RMS display materials 2006, 2008 and 2011, 2012 which are plan views of proposed corridor options overlaid on aerial photographs, community updates and technical investigations. (The documents provided for the preferred through-town alternative on the Central Corridor option contain more detail than the other alternatives.)
- RMS published reports including Traffic Reports, Paramics Traffic Modelling, Community Consultation, Business & Heritage Impacts assessments, Parking Study and Urban Design recommendations.
- RMS estimates of cost prepared between 2003 and 2011.
- RMS Estimating Manual and Economic Analysis Manual.

2.4.2 Information Developed by Evans & Peck

In undertaking this evaluation and preparing the estimates, Evans & Peck has developed:

- Scope and detail for the strategic corridor options together with rationalising the various versions of the through-town alternatives to provide consistency in design detail. The proposed design for the alternatives has changed over time and some alternatives contain different arrangements for the same location. Where possible and in conjunction with RMS the detail included in these scope definitions has been agreed;
- In completing this evaluation Evans & Peck have reviewed the supporting documentation and where necessary worked with RMS to define the strategic corridor options and detail for through town alternatives. It is recognised that the earlier routes have less design detail than the through town proposals now at the current stage;
- The proposed location for the East and West Bypass options is strategic with different route corridors shown on different plan views. The impact on property from the proposed designs has been estimated by overlaying the probable road corridor on land maps available from Wyong Shire Council and the Department of Lands. An estimate of the properties that may need to be acquired was assessed from these plans; and

- Evans & Peck has investigated the location of public utilities that may be affected via publicly available information such as 'Dial Before You Dig' plans. The investigation is desktop and consistent with preparation of strategic level estimates.

2.4.3 Information Not Provided or Available

The following information is not available for this independent evaluation:

- There are no assessments of potential environmental impacts such as flora, fauna, noise or vibration, indigenous heritage, town planning, flooding or wetlands for any of the options reviewed;
- The design information for the East and West Bypass is diagrammatic only. Concept design drawings were not available; and
- There are no Design Briefs or Design Reports for the corridor options or alternatives developed by RMS.

3 Cost Estimates

3.1 Overview

This section of the report responds to the terms of reference requirement to provide independent estimates of cost for:

1. the two bypass options displayed in 2006;
2. the five through-town options displayed in 2008, and
3. the revised preferred through-town option displayed in 2011-2012.

The alignment and extent of the strategic upgrade options (the Eastern and Western Bypass, the Central Corridor, and the through-town alternatives) are shown schematically in Figure 1 below.

The Evans & Peck cost estimates for the two bypass options are based on the scope described in the *Options Study, October 2006,* the *Options Study – Community Update, October 2006,* and the RMS corridor alignment diagrams overlaid on aerial photographs, dated May 2006. To complement the two bypass options, Evans & Peck also prepared a third estimate for the Central Corridor option which:

(a) completes the strategic overview with respect to the cost of bypass alternatives, and

(b) provides a point of reference to consider the advantages and disadvantages of each of the three corridor options investigated.

Together the Eastern, Western and Central corridors form the three strategic upgrade options investigated for the Pacific Highway at Wyong.

The five through-town alternatives for the Central corridor option for which cost estimates were prepared by Evans & Peck, comprise:

i. a Tunnel under the existing Pacific Highway through town;
ii. a Land Bridge, effectively a tunnel beside the existing Pacific Highway through town;
iii. an alignment using Howarth Street for southbound traffic;
iv. a Widening of the existing carriageway; and
v. a Split-Level Carriageway following the existing highway alignment.

These are the alternatives listed in the *Options Report, July 2008*. RMS provided Evans & Peck with separate concept design details for four of these five alternatives, generally covering the 2.1km upgrade between Johnson Road and Cutler Drive. A design for the 2008 Widened Carriageway (Alternative iv.) was not available from RMS. Instead the details of the Widened Carriageway are taken from the *Community Update, July 2008*.

The RMS Preferred Through-Town Option is the revised widening of the existing carriageway along the Central Corridor, as displayed in the *Community Update, November 2011*. RMS provided Evans & Peck with advanced design details of the 2011 option for estimating purposes, covering the 2.1km upgrade between Johnson Road and Cutler Drive. For strategic cost estimating purposes, the differences between the Widened Carriageway alternative 2008 and the preferred option 2011 are only minor. The differences relate to intersection treatments at Alison Road and

Church Street. Accordingly for this review the two options are reported with the same cost estimate.

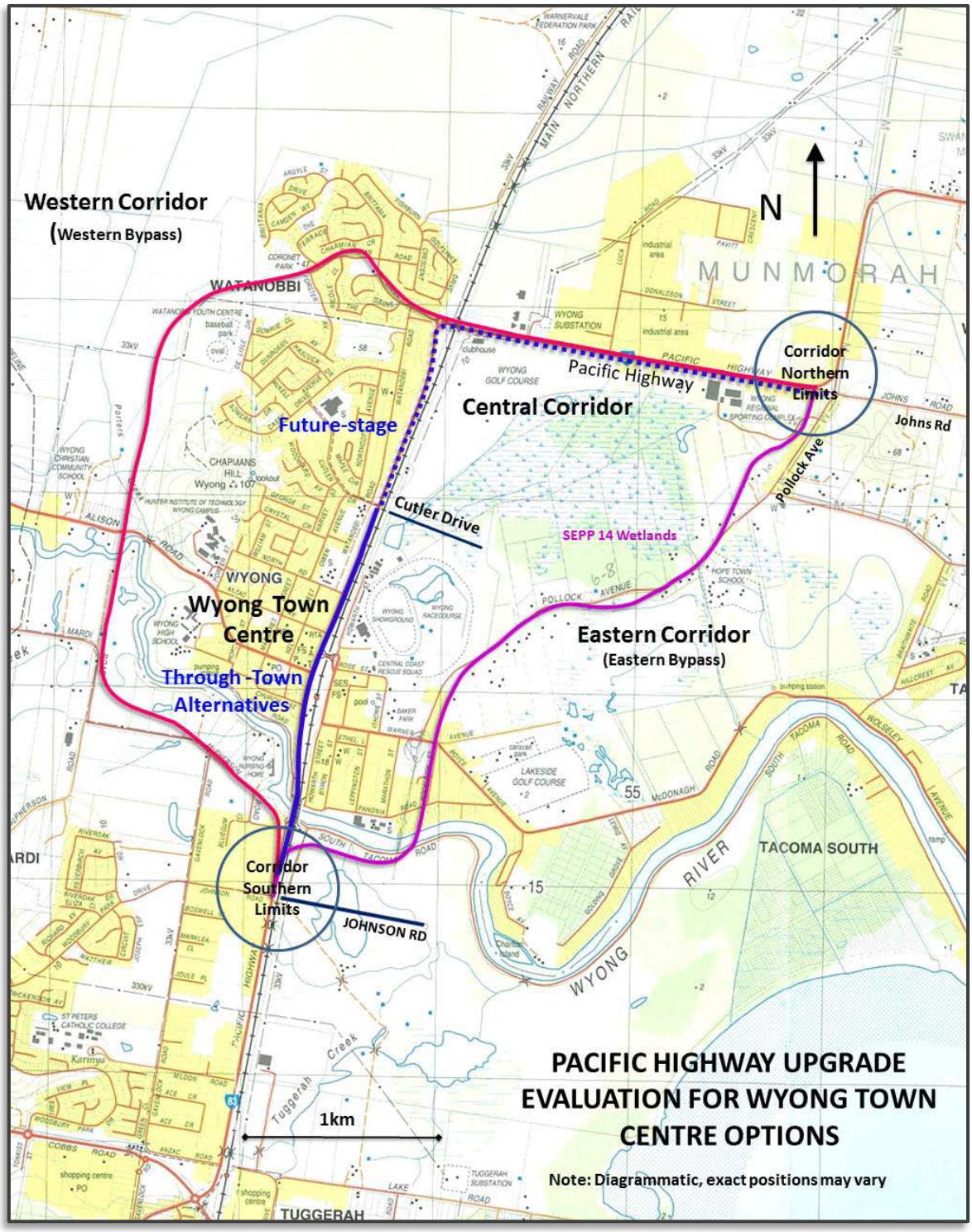


Figure 4: Corridor Route Options and Through-Town Alternatives

3.2 Components of the Estimate

All cost estimates have been prepared by Evans & Peck in accordance with the RMS Estimating Manual. Consistent with the preliminary design development, the estimates are strategic estimates in accordance with the RMS guidelines and have been prepared on the basis of total project cost. The estimates are broken down for each project phase into:

(a) Concept Development;
(b) Investigation and Design;
(c) Public Utilities;
(d) Property Acquisitions;
(e) Construction; and
(f) Project Finalisation.

Cost estimates were developed for individual work elements associated with delivery of each project phase, with additional allowances for project management and client representation. Contingency provisions were developed by qualitative evaluation within the guidelines of the RMS Estimating Manual, reflecting the design and scoping detail available and level of confidence in the estimate. Cost estimates supported by more complete design details such as the RMS 2011 preferred through town option, have a lower contingency provision included.

Evans & Peck has assumed the project will follow a traditional owner development delivery model, with design undertaken by external consultants and a 'construct only' delivery contract. Public utility adjustments are assumed to be included in the construction contract. Property acquisition is assumed to be managed by the owner with assistance provided by external consultants.

3.3 Summary of Cost Estimates

Evans & Peck's cost estimates for the strategic corridor options (2006), the through-town alternatives (2008), and the preferred Widened Carriageway (2011) are summarised below in Table 3. For comparison purposes, Table 3 also provides cost estimates for the through-town alternatives and preferred option adjusted to include the highway upgrade over the entire 5.1km length of the Central Corridor.

The cost estimate summary indicates that the Western Corridor ranks highest cost. The Western Corridor is significantly longer, requires more property to be acquired and has potentially greater impact on public utilities. The cost estimates for the Eastern and Central Corridor options are within 5% and at a strategic level, these estimates can be considered similar.

Of the through-town alternatives, the Tunnel and Howarth Street options rank highest cost and do not provide the road user benefits of the other alternatives. The Tunnel and Howarth Street options involve complex structures, extensive temporary works and higher risk, whilst not providing the improvements in travel time, capacity and intersection turning movements available with other options.

RMS reported that modelling shows the Tunnel option provides the least benefit in terms of improvements in travel time and intersection level of service, and results in significantly less surface capacity through Wyong town centre. The Land bridge alternative ranks marginally higher cost than the Widened and Split-Level Carriageway alternatives however, like the tunnel, does not provide the road user benefits of the other alternatives. At this strategic level, the estimates for the Widened and Split-level Carriageway options rank equal lowest cost.

Table 3: Cost Estimate Summary

Evans & Peck's Cost Estimate		Estimated Cost ($m)	Adjusted Cost ($m)[3]
Strategic Corridor Options 2006 [1]	Eastern Bypass (4.5km)	290	
	Western Bypass (6.9km)	410	
	Central Corridor (5.1km)	280	
Through-Town Alternatives (Central Corridor) 2008 [2]	Tunnel	360	500
	Land Bridge	150	280
	Howarth St	190	330
	Widened Carriageway	140	280
	Split-Level Carriageway	140	280
RMS Preferred Option 2011 [2]	Revised Widened Carriageway	140	280

Notes:

1. Strategic Corridor Option estimates include scope from Johnson Road, Tuggerah to Johns Road, Wadalba.
2. Through-Town Alternative estimates include scope from Johnson Road, Tuggerah to Cutler Drive, Wyong (2.1km).
3. Cost estimates adjusted for the entire 5.1km Central Corridor length, Johnson Rd, Tuggerah to Johns Rd, Wadalba
4. All amounts are in $(2012) terms.
5. Cost estimates have been rounded to the nearest $10m.

A more detailed discussion of each of the cost estimates is provided below.

3.4 Corridor Options – Eastern, Western and Central

RMS developed the concept designs for the corridor options to varying levels of detail. In assembling the cost estimates, Evans & Peck has relied on the general arrangement designs overlaid on aerial photographs, and incorporated other details from the RMS technical studies. After a gap analysis, the available design information was combined with additional project detail clarified and developed with RMS to provide clarity of scope and align the estimates with the current project requirements and expectations for an urban arterial road.

The study area for the Eastern, Central and Western Corridors extends from the Johnson Road intersection with Pacific Highway at Tuggerah to the Johns Road and Pollock Avenue intersection at Wadalba, north of Wyong.

3.4.1 Bypass Options Key Assumptions

To assist in defining the scope of the corridor options for estimating purposes, Evans & Peck has included the following key assumptions in each corridor option:

- Two traffic lanes provided in each direction, separated by a median barrier;
- Traffic lanes are 3.5m wide, with 2.5m outside shoulder, and 1.0m median shoulder;
- All embankments are at least one metre above existing natural surface (measured to the underside of the selected material zone) with a minimum 4:1 batter slope;
- Depth of the Selected Material Zone is at least 300mm with the top 150mm stabilised;

- Embankments include a 300mm Upper Zone of Formation capping layer beneath the Selected Material Zone;
- Pavements are 150mm Dense Graded Asphalt over 300mm Heavily Bound Base material;
- Verge width is minimum 1.0m on both sides, plus allowance for 2.4m wide shared cycleway and pedestrian path;
- All major intersections other than roundabouts are signalised;
- In urban environments the upgrade includes street lighting, kerb and gutter drainage, shared cycleway and pedestrian path both sides, property access, landscaping and provision for parking in the shoulder;
- In semi-rural environments the upgrade includes median drainage where required, property access, and landscaping treatment. A shared cycleway and pedestrian path is provided on one side only. Street lighting and kerb and gutter drainage are not provided; and
- Property acquisitions are assessed based on a full width corridor sufficient to accommodate a four-lane road, shared cycleway and public utility easements.

3.4.2 Eastern Bypass

The Eastern Corridor option is 4.5km long, beginning just south of Johnson Road at Tuggerah. The alignment rises to cross over the Main Northern Railway Line and the south bank of the Wyong River, before crossing the Wyong River on a new bridge and returning to grade near Panonia Road. The route continues north closely following the Pollock Avenue alignment to the roundabout at the intersection of Pacific Highway and Johns Road. The Eastern Corridor alignment plan is included in Appendix 1.

The new bridge over Wyong River will be four lanes wide with shoulders and provision for a shared cycleway. The Wyong River bridge will also span over a section of the floodplain south of South Tacoma Road.

Table 4: Eastern Bypass Cost Estimate

	Eastern Bypass	($m)	Contingency		($m)
			%	Amount	
1	Project Development	1.9	38%	0.7	2.7
2	Investigation and Design	6.2	48%	2.9	9.1
3	Property Acquisitions	88.7	55%	48.4	137.1
4	Public Utility Adjustments	5.0	98%	4.9	9.9
5	Construction of Works	92.8	44%	40.9	133.7
6	Handover	0.6	43%	0.2	0.8
	TOTAL	**$195**	**50%**	**$98**	**$293.3**
			ROUNDED TOTAL		**$290**

Notes:

1. All amounts in $(2012) terms.
2. The total amounts have been rounded to the nearest $10m.

Where the alignment crosses Panonia Road the existing road will be closed with a cul-de-sac either side. A signalised intersection at Warner Avenue will provide east-west access to Wyong. Various other cul-de-sac treatments and local road adjustments are required between Panonia Road and Johns Road.

The estimated cost for the Eastern Bypass is $290 million, with a strategic level construction program of 3.5 years, and overall contingency provision of 50%. Property acquisition and structures over the rail line and Wyong River comprise the largest cost elements.

The major project issues considered likely to impact on delivery are as follows:

- Construction of local road adjustments including the roundabout in Johnson Road and the approaches to the rail over bridge, are in close proximity to the current Pacific Highway south of the Wyong River. This section will be constructed under or adjacent to traffic. Traffic management issues will require well-considered solutions during construction and may require specialist traffic modelling to ensure the existing traffic capacity is maintained;
- Construction of the bridge over the Main Northern Rail Line is dependent on engaging with third parties i.e. CityRail The bridge geometry is skewed and construction access is constrained by the proximity of the existing Pacific Highway and the operational rail corridor;
- Establishing a corridor by acquiring property adjacent to new and established residential areas will be a challenge and require mitigation measures including noise walls and urban design treatments; and
- SEPP 14 Wetland issues at Wadalba will require environmental mitigation measures.

3.4.3 Western Bypass

The Western Corridor option is 6.9km long beginning just north of Johnson Road at Tuggerah. The alignment runs north-west and parallel to the Wyong River, crosses the river just south of Alison Road, and intersects Alison Road at grade to the west of Wyong High School. Further north the alignment turns east around Wyong Hill, passes through Watanobbi and connects to Brittania Drive, before crossing the Main Northern Rail Line and following the existing Pacific Highway to the roundabout at Johns Road intersection. The Western Corridor alignment plan is included in Appendix 2.

Local road adjustments are included near McPherson Road with a new intersection allowing northbound traffic to enter Wyong and southbound traffic from Wyong to join the new Pacific Highway.

Where the Western Bypass crosses Alison Road, a new signalised at-grade intersection is included allowing all traffic movements.

A new four-lane bridge over the rail line at Watanobbi, with pedestrian and cycleway facilities is included, and Evans & Peck has assumed the existing bridge will be demolished.

The estimated cost for the Western Bypass is $410 million, with a strategic level construction program of three years, and overall contingency provision of 50%. Property acquisition, structures, embankment earthworks, drainage and pavements comprise the largest cost elements.

Table 5: Western Bypass Cost Estimate

	Western Bypass	($m)	Contingency		($m)
			%	Amount	
1	Project Development	3.0	38%	1.2	4.1
2	Investigation and Design	6.6	48%	3.2	9.8
3	Property Acquisitions	137.1	53%	72.7	209.9
4	Public Utility Adjustments	16.1	100%	16.0	32.1
5	Construction of Works	112.1	39%	44.2	156.3
6	Handover	0.5	45%	0.2	0.7
	TOTAL	**$275**	**50%**	**$137**	**$412.9**
			ROUNDED TOTAL		**$410**

Notes:

1. All amounts in $(2012) terms.
2. The total amounts have been rounded to the nearest $10m.

The major project issues considered likely to impact on delivery are as follows:

- Establishing a corridor by acquiring property adjacent to and through established residential areas in Watanobbi will be a challenge and will require mitigation measures including noise walls and urban design treatments;
- Construction of a bridge over the Main Northern Rail Line is dependent on engaging with third parties i.e. CityRail. Construction access for the new bridge is constrained by the proximity of the existing Pacific Highway and working over the operational rail corridor; and
- Construction across the Wyong River and floodplain is subject to potential geotechnical, flooding and environmental risks which are still to be rigorously assessed.

3.4.4 Central Corridor

The Central Corridor is 5.1km long beginning just north of Johnson Road at Tuggerah, and uses the existing Pacific Highway through Wyong town centre, crossing over the rail line and continuing to follow the existing highway to the roundabout at Johns Road at Wadalba. The existing bridge over the Wyong River is duplicated with a two-lane bridge constructed on the western side.

A new four-lane bridge over the rail line at Watanobbi, with pedestrian and cycleway facilities is included, and Evans & Peck has assumed the existing bridge will be demolished.

Evans & Peck's cost estimate for the Central Corridor is based on design details from the 2.1km long 'preferred' through-town alternative (2011), combined with additional scope taken from the Western Corridor option for the 3.0km length between Cutler Drive and Johns Road roundabout.

The estimated cost for the Central Corridor is $280 million, with a strategic level construction program of three years, and overall contingency provision of 45%. Property acquisition and structures over the rail line and Wyong River comprise the largest cost elements.

Table 6: Central Corridor Cost Estimate

	Central Corridor	($m)	Contingency		($m)
			%	Amount	
1	Project Development	3.5	38%	1.3	4.8
2	Investigation and Design	7.6	48%	3.6	11.2
3	Property Acquisitions	36.7	54%	20.0	56.7
4	Public Utility Adjustments	18.0	98%	17.6	35.6
5	Construction of Works	123.7	34%	42.6	166.3
6	Handover	0.5	45%	0.2	0.7
	TOTAL	**$190**	**45%**	**$85**	**$275.3**
			ROUNDED TOTAL		**$280**

Notes:

1. All amounts in $(2012) terms.
2. The total amounts have been rounded to the nearest $10m.

The major project issues considered likely to impact on delivery are as follows:

- Major temporary works will be required in the town centre, such as relocation of the bus pickup and set down area adjacent to the railway station;
- Construction of a bridge over the Main Northern Rail Line is dependent on engaging with third parties i.e. CityRail. Construction access for the new bridge is constrained by the proximity of the existing Pacific Highway and working over the operational rail corridor;
- Provision for traffic and pedestrians during construction, particularly in the town centre and during peak periods, including temporary traffic management and traffic diversions;
- Extension of the Rose Street Bridge to be constructed under traffic;
- Disruption to retail trade and other businesses in Wyong town centre during construction; and
- Loss or severe impact on existing heritage buildings at Warners Shops and Station Master's Cottage.

3.5 Through-Town Alternatives

The study area for the through-town alternatives as defined by the available RMS designs, extends from Johnson Road in the south to Cutler Drive in the north, a distance of only 2.1 km. The cost estimates prepared for the through-town alternatives are based on this 2.1 km study area and represent only a part of the total project scope of the 5.1 km Central Corridor option.

3.5.1 Through-Town Alternatives Key Assumptions

To assist in defining the scope of the through-town alternatives for estimating purposes, Evans & Peck has included the following key assumptions in each option:

- Common scope has been assumed for all through-town alternatives (i) between Johnson Road and approximately 200m south of Church Street, and (ii) between North Road and Cutler Drive;
- This common scope has been based on the design details contained in the RMS preferred option (2011). These include a one-way service road between Johnson Road and South Tacoma Road, a short upgrade to South Tacoma Road, an upgrade for River Road with minor local road adjustments, and new intersections at North Road and Cutler Drive. The Howarth St alternative differs somewhat due to the transition of the southbound carriageway back to the existing highway alignment further south of Church St and further north of North Road;
- Between Church Street and North Road, the scope for each alternative has been developed from the RMS concept design details provided;
- An upgrade to the existing bridge over the Wyong River is included, comprising a new two-lane bridge duplication for northbound traffic and a shared pedestrian cycleway; and
- All alternatives other than the Howarth Street option, assume temporary relocation of the existing bus set down and pick-up areas on the west side of the railway station will be required.

3.5.2 Tunnel

The Tunnel alternative involves constructing a deep tunnel beneath the town centre, generally under the existing highway alignment. The tunnel would be approximately 750m long, accommodate two lanes northbound and two lanes southbound and include an exhaust ventilation facility.

The Tunnel alignment plan and Evans & Peck's detailed cost estimate and program are included in Appendix 4 of this report.

The estimated cost for the Tunnel alternative is $360 million, with a strategic level construction program of 4.5 years, and overall contingency provision of 60%.

Table 7: Tunnel Cost Estimate

	Tunnel	($m)	Contingency		($m)
			%	Amount	
1	Project Development	2.9	38%	1.1	4.1
2	Investigation and Design	9.2	48%	4.4	13.6
3	Property Acquisitions	8.0	54%	4.4	12.4
4	Public Utility Adjustments	13.5	97%	13.1	26.6
5	Construction of Works	190.8	59%	111.8	302.7
6	Handover	0.5	45%	0.2	0.7
	TOTAL	**$225**	**60%**	**$135**	**$360.1**
			ROUNDED TOTAL		**$360**

Notes:

1. All amounts in $(2012) terms.
2. The total amounts have been rounded to the nearest $10m.

The major project issues considered likely to impact on the delivery are as follows:

- Costly temporary works and major provisions for traffic management will be necessary. This includes a temporary southbound carriageway to divert traffic under Rose Street Bridge and create a construction zone for tunnelling operations, relocation of traffic lanes where insufficient support exists above the tunnel excavation during construction and temporary support and bridging across the tunnel portals to maintain local traffic access into Wyong town centre;
- A tunnel exhaust ventilation facility if required, will be located close to the town centre and is likely to generate significant community concerns;
- Extensive construction noise and dust from major rock excavation activities in the town centre is expected, requiring mitigation measures;
- Extremely limited construction area for heavy vehicle movements and the removal of excavated tunnel spoil;
- Major disruptions to retail businesses and on-street parking during construction. Existing vehicle turning movements at intersections may not be maintained during construction;
- Ground vibration during tunnelling operations may effect rail operations and maintenance;
- Significant disruption expected to traffic and pedestrians during construction; and
- The Rose Street Bridge will require extension under traffic for temporary works.

3.5.3 Land Bridge

The Land Bridge alternative is a variation on the tunnel with the new four-lane carriageway directed under Rose Street and through a concrete box section in the area currently occupied by the commuter car park. A new covered landscaped area will replace the current transport interchange. The existing highway adjacent to retail and business premises will become a service road. This alternative will require the removal of all heritage buildings on the eastern side of the highway near Church Street.

Table 8: Land Bridge Cost Estimate

	Land Bridge	($m)	Contingency		($m)
			%	Amount	
1	Project Development	2.9	38%	1.1	4.1
2	Investigation and Design	4.8	47%	2.3	7.1
3	Property Acquisitions	7.8	54%	4.2	12.1
4	Public Utility Adjustments	11.9	97%	11.6	23.6
5	Construction of Works	72.9	36%	25.9	98.9
6	Handover	0.5	45%	0.2	0.7
	TOTAL	**$101**	**45%**	**$45**	**$146.5**
			ROUNDED TOTAL		**$150**

Notes:

1. All amounts are in $(2012) terms.
2. The total amounts have been rounded to the nearest $10m.

The Land Bridge alignment plan and Evans & Peck's detailed cost estimate and program are included in Appendix 5 of this report.

The estimated cost for the Land Bridge alternative is $150 million, with a strategic level construction program of 2.5 years, and overall contingency provision of 45%.

The major project issues considered likely to impact on the delivery are as follows:

- Major temporary works required such as relocation of the bus pickup and set down area adjacent to the railway station;
- Disruption and provision for traffic and pedestrians during construction, particularly in the town centre and during peak periods, including temporary traffic management and traffic diversions;
- Extension of the Rose Street Bridge to be constructed under traffic;
- Disruption to retail trade and other businesses in Wyong town centre during construction; and
- Loss of existing heritage buildings at Warners Shops and Station Master's Cottage.

3.5.4 Howarth Street

The Howarth Street alternative provides a new unidirectional two-lane southbound carriageway east of the railway line along Howarth Street, with the existing Pacific Highway reverting to northbound only through the town centre. The new alignment would be as close to the railway line as possible, crossing over the railway north of Rose Street and again just south of the railway station. This alternative requires extensive retaining walls and two bridge structures over the Main Northern Rail Line. From the design provided it is assumed that the existing commuter car park west of the railway station will remain largely unchanged.

Table 9: Howarth Street Cost Estimate

	Howarth Street	($m)	Contingency		($m)
			%	Amount	
1	Project Development	2.9	38%	1.1	4.1
2	Investigation and Design	4.8	47%	2.3	7.1
3	Property Acquisitions	8.0	59%	4.7	12.7
4	Public Utility Adjustments	17.6	98%	17.3	34.9
5	Construction of Works	99.7	35%	34.6	134.2
6	Handover	0.5	45%	0.2	0.7
	TOTAL	**$133**	**45%**	**$60**	**$193.7**
			ROUNDED TOTAL		**$190**

Notes:

1. All amounts are in $(2012) terms.
2. The total amount has been rounded to the nearest $10m.

The Howarth Street alignment plan and Evans & Peck's detailed cost estimate and program are included in Appendix 6 of this report.

The estimated cost for the Howarth Street alternative is $190 million, with a strategic level construction program of three years, and overall contingency provision of 45%.

The major project issues considered likely to impact on the delivery are as follows:

- Construction of two bridges over the northern rail line is dependent on engaging with third parties i.e. CityRail. Construction access for the new bridges is constrained by working over the operational rail corridor;
- Disruption to traffic and pedestrians during construction, especially access from the eastern side of the rail line to the retail precinct on the west side;
- Extension of the Rose Street Bridge to be constructed under traffic; and
- Disruption to availability of the commuter car parks on the west and east sides of the rail line during construction.

3.5.5 Widened Existing Carriageway

The option to widen the existing highway will provide a new four-lane at-grade carriageway through the town centre. At Church St intersection the new carriageway widening is assumed to fit between the existing heritage buildings and the retail premises with minimal impact on those buildings. A southbound bus lane will diverge from the highway north of Rose Street and divert under the Rose Street Bridge to access the bus set down and pickup area at the railway station, and adjacent commuter car park.

Table 10: Widened Carriageway Cost Estimate

	Widened Carriageway	($m)	Contingency		($m)
			%	Amount	
1	Project Development	3.1	38%	1.2	4.3
2	Investigation and Design	4.8	47%	2.3	7.1
3	Property Acquisitions	7.8	54%	4.2	12.1
4	Public Utility Adjustments	12.0	97%	11.6	23.6
5	Construction of Works	73.7	23%	16.6	90.3
6	Handover	0.5	45%	0.2	0.7
	TOTAL	**$102**	**35%**	**$36**	**$137.8**
			ROUNDED TOTAL		**$140**

Notes:

1. All amounts are in $(2012) terms.
2. The total amount has been rounded to the nearest $10m.

A design for the 2008 Widened Carriageway alternative was not available from RMS. Based on a review of the *Community Update - July 2008*, the differences between the Widened Carriageway alternative 2008 and the Preferred Option 2011 are minor and relate to intersection treatments only. Accordingly for this review the cost estimate for the Widened Carriageway is based largely on the 2011 Preferred Option design. Evans & Peck's detailed cost estimate and program for the Widened Carriageway alternative are included in Appendix 7 of this report.

The estimated cost for the Widened Existing Carriageway alternative is $140 million, with a strategic level construction program of three years, and overall contingency provision of 35%.

The major project issues considered likely to impact on the delivery are as follows:

- Significant temporary works required to relocate the bus pickup and set down area to the east side of the railway station;
- Loss of parking in the existing western commuter car park during construction;
- Disruption and provision for traffic and pedestrians during construction particularly in the town centre and during peak periods, including temporary traffic management and traffic diversions;
- Extension of the Rose Street Bridge to be constructed under traffic; and
- Disruption to retail trade and other businesses in Wyong town centre during construction.

3.5.6 Split-Level Carriageway

The Split-Level Carriageway alternative will retain the northbound carriageway on the existing highway alignment and a new southbound carriageway will be constructed at a lower level through the existing commuter car park and under the Rose St Bridge.

The Split-Level Carriageway alignment plan and Evans & Peck's detailed cost estimate and program are included in Appendix 8 of this report.

Table 11: Split-Level Carriageway Cost Estimate

	Split-Level Carriageway	($m)	Contingency		($m)
			%	Amount	
1	Project Development	3.1	38%	1.2	4.3
2	Investigation and Design	4.8	47%	2.3	7.1
3	Property Acquisitions	7.8	54%	4.2	12.1
4	Public Utility Adjustments	12.0	97%	11.6	23.6
5	Construction of Works	74.3	28%	20.1	95.2
6	Handover	0.5	45%	0.2	0.7
	TOTAL	**$103**	**39%**	**$40**	**$143.0**
			ROUNDED TOTAL		**$140**

Notes:

1. All amounts are in $(2012) terms.
2. The total amount has been rounded to the nearest $10m.

The estimated cost for the Split-Level Carriageway alternative is $140 million, with a strategic level construction program of 3.5 years, and an overall contingency provision of 39%.

The major project issues considered likely to impact on the delivery are as follows:

- Significant temporary works required to relocate the bus pickup and set down area to the east side of the railway station;
- Loss of parking in the existing western commuter car park during construction;
- Disruption and provision for traffic and pedestrians during construction particularly in the town centre and during peak periods, including temporary traffic management and traffic diversions;
- Extension of the Rose Street Bridge to be constructed under traffic;
- Disruption to retail trade and other businesses in Wyong town centre during construction; and
- Loss of heritage buildings at Church St intersection.

3.5.7 Preferred Option - Widen Existing Carriageway

The single revised preferred through-town option is an improved version of the Widened Carriageway alternative which provides improved traffic access to and from the eastern side of the rail line. Traffic lights are modified to allow for all turn movements at the intersection of Rose Street and the Pacific Highway. The right turn bay at Alison Road is removed and replaced by a new right turn bay at Church Street. The exit from the commuter car park and transport interchange is one-way out only. At this level of detail the difference between cost estimates for the Widened Carriageway and the RMS Preferred Option is minimal.

The Preferred Option alignment plan and Evans & Peck's detailed cost estimate and program are included in Appendix 9 of this report.

Table 12: Widened Carriageway – RMS Preferred Option Cost Estimate

	Preferred option	($m)	Contingency		($m)
			%	Amount	
1	Project Development	3.1	38%	1.2	4.3
2	Investigation and Design	4.8	47%	2.3	7.1
3	Property Acquisitions	7.8	54%	4.2	12.1
4	Public Utility Adjustments	12.0	97%	11.6	23.6
5	Construction of Works	73.7	23%	16.6	90.3
6	Handover	0.5	45%	0.2	0.7
	TOTAL	**$102**	**35%**	**$36**	**$138.1**
			ROUNDED TOTAL		**$140**

Notes:

1. All amounts are in $(2012) terms.
2. The total amount has been rounded to the nearest $10m.

The estimated cost for the Preferred Option to widen the existing carriageway is $140 million, with a strategic level construction program of three years, and an overall contingency provision of 35%.

The major project issues considered likely to impact on the delivery are similar to the Widened Carriageway alternative, as follows:

- Significant temporary works required to relocate the bus pickup and set down area to the east side of the railway station;
- Loss of parking in the existing western commuter car park during construction;
- Disruption and provision for traffic and pedestrians during construction particularly in the town centre and during peak periods, including temporary traffic management and traffic diversions;
- Extension of the Rose Street Bridge to be constructed under traffic;
- Disruption to retail trade and other businesses in Wyong town centre during construction; and
- Adjustments to and potential loss of the heritage buildings at Church St intersection (under treatment Option 2).

3.6 General Notes and Assumptions

All of the cost estimates prepared by Evans & Peck are based on scope either identified in RMS documentation or clarified in discussions with RMS. For the eastern and western bypass strategic corridor options only aerial alignment plans were available from RMS. For the Central Corridor through-town alternatives more specific design details including longitudinal sections and some cross sectional details were available. The strategic design for the RMS Preferred Option was the most complete of all the options, and included detail plans, intersection layouts, typical cross sections and longitudinal sections.

The cost estimates have been prepared inclusive of the following general assumptions and considerations:

- The impact on property was assessed by overlaying the proposed road corridor on land maps available from Wyong Shire Council and the Department of Lands. The cost of property acquisition is based on average market values in the local area with an additional allowance for legal and other acquisition costs. Where partial property acquisition was considered likely, the area of affected land was estimated and a square metre rate applied based on average market value plus additional allowance. Where commercial properties with established assets were identified, the estimated cost includes both property cost and a further allowance for the existence of the assets;
- Evans & Peck does not consider the feasibility of relocating the Station Master's Cottage has been reasonably assessed by RMS, and costs have not been adequately determined by RMS' heritage consultant. Accordingly, an allowance is included in the cost estimate for demolition only, and there is no additional cost provision to relocate the Cottage. Should relocation be considered feasible by RMS, it will be complex and costly;
- The cost estimates do not include allowance for loss of business, retail trade or the commercial value of any business affected by the project;
- Costs for adjustments to public utilities are based on a desktop study identifying utilities likely to be impacted from information available from 'Dial Before You Dig', Wyong Shire Council charts and public utility company web sites. Site inspections were also undertaken to further identify

public utility plant potentially impacted by the proposals. For this high level review, the remaining uncertainty of utility adjustments scope is considered to be included in the conservative contingency provision;

- Depth of topsoil stripping (where required) is assumed to be 300mm from natural surface level;
- In the absence of detailed geotechnical information an allowance for ground improvement is included in the estimate where the alignment traverses the Wyong River floodplain Surcharging and wick drains are included for the full width of the carriageway over a distance of 1,500 metres;
- Except where fully detailed cross sections have been provided by RMS, earthwork fill quantities are based on an assumed embankment cross-section suitable for a four-lane carriageway and cut volumes have been estimated from topographical maps;
- In urban areas, fill volumes are based on the constructed height of embankments after stripping topsoil and allowance for removing unsuitable material;
- All excavated material is assumed spoiled to low-lying fill areas, spread and compacted. Spoil material such as asphalt or concrete is assumed to be disposed through a recycling tip with a nominal tipping fee included;
- The feasibility of the proposed RMS strategic designs and assumptions regarding scope have not been verified by Evans & Peck as part of this review;
- Evans & Peck consider that all through-town alternatives will require the temporary relocation of the bus pick-up and set-down area from the west side of the rail line to the east side during construction. An allowance is included in the cost estimates for substantial temporary works to facilitate this relocation;
- There is no provision in the estimates for temporary commuter car parking during construction or a new eastern parking facility in the final design. This is consistent with RMS advice to omit the eastern car park shown on some design drawings. The existing eastern car park facilities are assumed adequate; and
- An allowance has been included for noise walls over a nominal length of 1.0 km on both sides of the Eastern and Western Bypass options.

3.7 Conclusion

The Evans & Peck cost estimates for the Eastern Corridor (Eastern Bypass) and Central Corridor are $290 million and $280 million respectively, including 50% and 45% contingency allowance respectively. A higher contingency has been allowed for the Eastern Bypass since the option is not developed to the same level of design detail by RMS as the through-town preferred option which forms part of the Central Corridor.

The lower construction cost component for the Eastern Bypass is offset by the higher cost of property acquisition. The lower property cost component for the Central Corridor is offset by the disruption costs of reconstructing the highway through Wyong town centre. There may be other risk issues that determine the lowest cost option, however there is insufficient information available for this review to include these costs in detail (for example, more extensive ground improvements, specific environmental mitigation measures, or increased impact on the rail line). The cost estimates for the Eastern and Central Corridor options are within 5% and at a strategic level, these

estimates can be considered similar. The Eastern Bypass should be considered for further study and confirmation by RMS that the strategic design as provided for this review, is feasible.

The Evans & Peck cost estimate for the Western Bypass of $410 million ranks highest cost, and the new road corridor proposed through Watanobbi residential precinct would have high community impact. The potential costs for disruption and delayed project approvals have not been included in this cost estimate.

The cost estimates for the Tunnel and Howarth Street options of $360 million and $190 million respectively rank highest cost of the five through-town alternatives and do not provide the road user benefits of the other through-town alternatives.

The cost estimates for the Land Bridge, Split-Level Carriageway and the RMS Preferred Widened Carriageway option is $150 million, $140 million and $140 million respectively. The contingency included is 45%, 39% and 35% respectively reflecting the varying level of design detail available for this review. The three cost estimates are all within 10% and at a strategic level these estimates should be considered similar. However the Land Bridge alternative does not provide the road user benefits of either the Widened Carriageway or the Split-Level Carriageway.

4 Initial RMS Estimates – Variance Analysis

4.1 Overview

This section responds to the terms of reference requirement to provide a detailed report on each of the cost estimates for each of the through-town and bypass options, comparing Evans & Peck's independent cost estimates with the initial RMS estimates, and highlighting the differences found from the initial estimates of cost with reasoning for those differences where possible.

To undertake a comparison of RMS and Evans & Peck estimates, the RMS estimates first required adjusting to current pricing, and the Evans & Peck estimates required scope adjustment to ensure a common route length.

The RMS estimates were prepared in the same format as the independent cost estimates for this review, following the RMS Estimating Manual Guidelines, which allows a direct comparison of the key components of each estimate. As the RMS estimates were prepared in 2006, 2007 and 2012, a cost escalation factor has been applied to allow comparison with the Evans & Peck estimates at current 2012 pricing. Escalation of 5% per annum has been assumed for this cost adjustment, giving a cost escalation factor of 1.34 and 1.27 for 2006 and 2007 estimates respectively. By comparison, escalation from the ABS Producer Price Index for Road and Bridge Construction, NSW (Index No. 3101) for the same periods is 1.27 and 1.22, or within 5% of the escalation assumed for this review.

The original RMS estimates issued to Evans & Peck and the corresponding adjusted project cost estimates used for this variance analysis, are summarised in Table 13 below.

Table 13: RMS Estimates Issued for Comparison

RMS Cost Estimates		Route Length (km)	Date	Project Cost ($m)	Escalated to $2012 ($m)
Strategic Corridor Options 2006	Eastern Bypass	4.58	2006	197	264
	Western Bypass	6.92	2006	312	418
Through-Town Alternatives (Central Corridor) 2008	Tunnel	5.11	2007	431	550
	Land Bridge	5.11	2007	219	280
	Howarth St	5.11	2007	258	329
	Widened Carriageway	Not available for review			
	Split-Level Carriageway	5.11	2006	146	196
RMS Preferred Option 2011	Widened Carriageway	2.06	2012	155	155

RMS provided Evans & Peck with cost estimates for seven of the eight upgrade options considered by this review, but (with the exception of the RMS Preferred Option) were unable to confirm the precise design data supporting each of the estimates. With incomplete information available, Evans

& Peck was unable to verify the design documentation referenced by RMS in preparing the scope of the initial strategic estimates and verify the approach to deriving scope and quantum of work. For this review the scope of RMS estimates has been determined, as far as possible, from analysing the worksheets accompanying the estimates. Given this information gap, the RMS and Evans & Peck cost estimates may not be based on identical concept design data. This is considered a key limitation of the cost comparison of scope and project constraints.

Evans & Peck's approach to preparing the estimates involved determining the RMS preferred scope of each proposal with reference to the design documentation provided, and including identification and pricing of project constraints, key risks and the likely time for delivery.

It is evident that the scope of the RMS estimates differs in some cases from the Evans & Peck estimates in respect of the route length priced. The RMS estimates for the through-town alternatives include the full length of the corridor between Johnson Road, Tuggerah and Johns Road, Wadalba. In contrast, Evans & Peck estimates for the five through-town designs issued by RMS include a 2.1km upgrade only between Johnson Road, Tuggerah and Cutler Drive.

Accordingly in response to the Terms of Reference, the Evans & Peck estimates have been adjusted to compensate for the increased scope and allow comparison over the full corridor length, with the additional costs for Cutler Drive to Johns Road taken from the western bypass estimate. This aggregation of estimates is at best an approximation which reduces the reliability of the estimate comparison and is considered a second limitation of the cost comparison.

The differences between the RMS and Evans & Peck estimates are summarised in section 4.2 below. Cost differences identified at project phase level are also explained to the extent possible. A more detailed comparison of each option is provided in section 4.3.

4.2 Difference Summary

The differences in total project cost between the RMS and the Evans & Peck cost estimates are provided in Table 14.

The comparison of estimates is limited to two of the three corridor options, four of the five through-town alternatives, and the RMS Preferred Widened Carriageway option. The 5.1km Central Corridor option using the Widened Carriageway alternative was not priced by RMS. The RMS estimate for the 2008 Widened Carriageway alternative was not available for this review. Of the through-town alternatives, the shorter 2.1km preferred option is the only RMS estimate available to correspond directly to the scope of the Evans & Peck estimates required under the Terms of Reference.

The remaining four Evans & Peck cost estimates for the through-town alternatives were not directly comparable without scope adjustment for the full length corridor.

Table 14: Comparison of Estimates

Cost Estimate		RMS $2012 ($m)	E&P ($m)	E&P Adjusted ($m) [1]	Difference ($m)	Difference %
Strategic Corridor Options 2006	Eastern Bypass	264	290		+26	+10%
	Western Bypass	418	410		-8	-2%
	Central Corridor[3]	-	280		-	-
Through-Town Alternatives Central Corridor 2008 (5km)	Tunnel	550		500	- 50	-9%
	Land Bridge	280		280	0	0%
	Howarth St	329		330	+1	+0%
	Widened Carriageway[2, 4]	-		280	-	-
	Split-Level Carriageway	196		280	+84	+43%
RMS Preferred Option 2011	Widened Carriageway[2] (2km)	155	140		-15	-10%

Notes:

1. Cost adjusted for comparison of route length of 5.1km from Johnson Road, Tuggerah to Johns Road, Wadalba - from Table 3 in Section 3.
2. The Widened Carriageway scope is from Johnson Road, Tuggerah to Cutler Drive.
3. Central Corridor not priced by RMS
4. RMS estimate for Widened Carriageway 2008 not available.
5. All amounts are in $(2012)

At this high level comparison, the variance between the RMS and Evans & Peck estimates is within 10% for six of the seven cost estimates, with only the Split-Level Carriageway option indicating significant variance of 43%. However the RMS estimate for the Split-Level alternative is considered unreliable as noted below in section 4.3.6 and the actual variance is much less. The ranking of corridor options appears similar with the Western Corridor the highest cost. The ranking of the through-town options also appears similar with the Tunnel option the highest cost.

Cost differences identified in the estimates at project phase level are explained below.

4.2.1 Project Development, Investigation and Design.

Evans & Peck has considered and priced from first principles the cost of potential technical investigation consultants required for the *Project Development* and *Investigation and Design* project phases. The RMS estimates apply a percentage of construction cost as the basis for costing technical investigations. Although the resulting amounts are lower in the Evans & Peck estimates they represent a consistent allowance for each option and have been adopted across the range of estimates. This item represents the most significant difference between estimates for Project Development and Investigation and Design.

This cost difference, although high in percentage difference terms, is small when the effect on the total project cost is considered.

4.2.2 Property Acquisition

The Evans & Peck estimates of property acquisition include reference to NSW Department of Lands property maps and the identification of individual properties potentially requiring acquisition either in part or whole. The corridor width assumed by Evans & Peck appears to be wider than RMS thereby impacting additional properties. Land and property values used in the Evans & Peck estimate are based on current market values taken from publicly available information, and are higher than assumed by RMS. As a result of higher land values and number of affected properties, property costs are generally higher in the Evans & Peck estimates, and are significantly higher for the Eastern and Western Corridor options.

RMS has allowed a 100% contingency for property acquisition, considerably higher than Evans & Peck's allowance of 55%. As a result, RMS estimates for the Tunnel, Howarth Street, Land Bridge and Split-Level alternatives appear higher than the Evans & Peck estimates.

In contrast, the estimated cost of property acquisition for the Widened Carriageway appears similar in both estimates.

4.2.3 Public Utility Adjustments

The Evans & Peck estimates for public utility adjustments are based on identifying the location of public utilities that are potentially affected by each of the options via publicly available information such as 'Dial Before You Dig' plans, utility authority maps, photographs and field observation. The cost estimates are provisional only and are generally lower in Evans & Peck's estimates. As scope is not well defined at this strategic level of investigation, the costs are likely to vary significantly with further detail design and confirmation of requirements of public utility authorities, and a high contingency has been included. Evans & Peck is unable to properly verify differences with the RMS estimates without the supporting details used by RMS.

The cost differences, although high in percentage difference terms, are small when considering the effect on the total project cost.

4.2.4 Construction

The Evans & Peck estimates include allowances for ground improvement, noise mitigation, extensive temporary works, and the inclusion of additional items of scope which have all contributed to higher direct construction costs. The estimates also include time related costs based on strategic level programs developed for each of the options. Although not immediately evident in the variance analysis, these elements have contributed to higher amounts included in the Evans & Peck estimates at direct cost level.

The RMS estimates are based on various differences in scope compared to Evans & Peck, such as traffic lane widths, road corridor width, and embankment formation width and height. Evans & Peck has developed scope in consultation with RMS and these details are included as a basis for the estimates to improve confidence in the outcome. The RMS estimates include higher contingency allowances reflecting more uncertainty in scope. Clearly the scope of options requires verification, as the combination of difference in scope and applied contingency has led to significant differences in the cost estimates.

4.2.5 Handover

The Evans & Peck estimate includes detailed amounts for all handover elements in lieu of allowing a percentage of the construction cost as RMS has done. The difference is not significant with respect to total project cost.

4.3 Estimate Differences

This section considers the differences for each project phase of the individual estimates to identify reasons for variance where possible. Some of the estimates contain apparent differences between RMS and Evans & Peck in the assumed length of the project, however these differences are not considered significant to the analysis.

4.3.1 Eastern Bypass

Table 15: Estimate Variance - Eastern Bypass

Eastern Bypass	RMS $2012 ($m)	E&P ($m)	Difference ($m)	Difference % of RMS Total
Project Development	4.8	2.7	-2.1	-0.8%
Investigation and Design	6.8	9.1	+2.3	+0.9%
Property Acquisitions	75.4	137.1	+61.7	+23.4%
Public Utility Adjustments	18.6	9.9	-8.7	-3.3%
Construction of Works	157.2	133.7	-23.5	-8.9%
Handover	1.1	0.8	-0.3	-0.1%
TOTAL	**264**	**293**	**+29**	**+11%**

Notes

1. RMS estimated amounts have been cost adjusted to $(2012) terms.

From Table 15 above, there is an apparent difference in construction cost of $24 million. However the estimated direct costs of construction for each estimate are within 10% and the difference lies in the infrastructure contingency allowance of 45% and 100% for Evans & Peck and RMS respectively.

Evans & Peck's estimate for property acquisition costs is significantly higher for the Eastern Bypass as discussed previously, representing the largest element of cost variance. Property costs are highly dependent on the accuracy of market values applied, and are not Evans & Peck's area of expertise. The RMS estimate also contains disclaimers in this regard. As a major cost component it would be prudent for RMS's property division to review the property acquisition costs and contingency to improve certainty of the likely cost.

Overall the difference in estimates amounts to 11% of the RMS project cost (escalated to current pricing) with Evans & Peck's estimate approximately $29 million higher than RMS. This difference is well within the difference in overall contingency of 50% and 90% included in the Evans & Peck and RMS estimates respectively.

4.3.2 Western Bypass

Table 16: Estimate Variance - Western Bypass

Western Bypass	RMS $2012 ($m)	E&P ($m)	Difference ($m)	Difference % of RMS Total
Project Development	6.3	4.1	-2.1	-0.5%
Investigation and Design	9.0	9.8	+0.8	+0.2%
Property Acquisitions	159.6	209.9	+50.3	+12.0%
Public Utility Adjustments	33.4	32.1	-1.3	-0.3%
Construction of Works	208.4	156.3	-52.1	-12.5%
Handover	1.4	0.7	-0.8	-0.2%
TOTAL	**418**	**413**	**-5**	**-1%**

Notes

1. RMS estimated amounts have been cost adjusted to $(2012) terms.

From Table 16 above there is an apparent difference in construction cost of $52 million. The RMS estimate includes a new two-lane bridge over the railway line at Watanobbi. The Evans & Peck estimate, at this location includes a new four-lane bridge with facilities for pedestrians and cyclists and additional signalised intersections. It also includes demolition of the existing bridge, which is not included in the RMS estimate. There are also substantial differences in earthworks with Evans & Peck assessing higher quantities.

Despite the increased scope in the Evans & Peck estimate, the difference in infrastructure contingency allowance of 40% and 100% by Evans & Peck and RMS respectively has resulted in an overall higher construction cost by RMS.

Similar to the Eastern Bypass, Evans & Peck's estimate for property acquisition costs is significantly higher for the Western Bypass as discussed previously, representing one of the largest elements of cost variance. Again it would be prudent for RMS's property division to review the property acquisition costs and contingency to improve certainty of the likely cost.

Overall the difference in estimates amounts to less than 1% of the RMS project cost (escalated to current pricing). Although similar project cost outcomes, the estimates include substantially different overall contingency of 50% and 92% by Evans & Peck and RMS respectively.

4.3.3 Tunnel

From Table 17 below there is an apparent difference in construction cost of $13 million. Evans & Peck excavation quantities for pavement reconstruction are based on excavation full depth to the underside of the selected material earthwork zone. By comparison the RMS estimate calculates volumes between existing surface levels and the proposed new design surface levels. This method understates the actual excavated volumes.

Table 17: Estimate Variance - Tunnel

Tunnel	RMS $2012 ($m)	E&P Adjusted ($m)	Difference ($m)	Difference % of RMS Total
Project Development	14.0	5.5	-8.5	-1.5%
Investigation and Design	23.5	18.7	-4.8	-0.9%
Property Acquisitions	50.4	17.0	-33.4	-6.1%
Public Utility Adjustments	30.0	36.5	+6.5	-1.2%
Construction of Works	429.0	416.1	-12.9	-2.3%
Handover	3.2	0.9	-2.3	-0.4%
TOTAL	**550**	**495**	**-55**	**-10%**

Notes

1. RMS estimated amounts have been cost adjusted to $(2012) terms.
2. Evans & Peck estimate is cost adjusted to compensate for scope difference - for comparison of route length of 5.1km from Johnson Road, Tuggerah to Johns Road, Wadalba

For the tunnel excavation including the cut and cover portals and excavation for piling, RMS has a volume of 130,000m^3 compared to Evans & Peck's 99,000m^3, a difference of 30%. Similarly for the exhaust ventilation facility and mechanical and electrical equipment, RMS has allowed $42 million compared to Evans & Peck's $22 million.

RMS has allowed for the disposal of tunnel spoil at tip sites, whilst the Evans & Peck estimate allows for excavated material to be spread over adjacent land where possible at a lower cost.

The Evans & Peck estimate also includes costs for extensive temporary works associated with the tunnel construction.

The infrastructure contingency allowance is similar for both estimates, with Evans & Peck including 60% and RMS including 70% contingency.

Property represents the largest element of cost variance. Evans & Peck's estimate for property acquisition costs is significantly lower than RMS for the Tunnel option. Whilst the Evans & Peck cost estimate is informed by the through-town property acquisition plan issued by RMS, the estimate may understate the acquisition costs. Again it would be prudent for RMS's property division to review the property acquisition costs for the tunnel option.

Overall the difference in estimates amounts to 10% of the RMS project cost (escalated to current pricing) with Evans & Peck's estimate approximately $55 million lower than RMS. This difference is within the difference in overall contingency of 60% and 69% included in the Evans & Peck and RMS estimates respectively.

4.3.4 Land Bridge

From Table 18 below there is an apparent difference in construction cost of $11 million and a further difference in public utility cost of $12 million. The difference in construction direct costs increases further after adjusting for infrastructure contingency provision of 36% and 70% for Evans & Peck and RMS estimates respectively. Evans & Peck has estimated higher construction and

utility costs, identifying more utility work and allowing full pavement reconstruction in lieu of asphalt overlay between Cutler Drive and Johns Road, and allowing for a new four lane bridge to replace the existing rail overbridge.

Table 18: Estimate Variance – Land Bridge

Land Bridge	RMS $2012 ($m)	E&P Adjusted ($m)	Difference ($m)	Difference % of RMS Total
Project Development	6.1	6.1	0	-
Investigation and Design	10.3	13.5	+3.2	+1.1%
Property Acquisitions	49.5	23.2	-26.3	-9.4%
Public Utility Adjustments	33.3	45.2	+11.9	+4.3%
Construction of Works	178.9	190.0	+11.1	+4.0%
Handover	1.4	1.2	-0.2	-0.1%
TOTAL	**279**	**279**	**Nil**	**Nil**

Notes

1. RMS estimated amounts have been cost adjusted to $(2012) terms.
2. Evans & Peck estimate is cost adjusted to compensate for scope difference - for comparison of route length of 5.1km from Johnson Road, Tuggerah to Johns Road, Wadalba.

Property represents the largest element of cost variance for this option. Similar to the Tunnel option, Evans & Peck's estimate for property acquisition costs is significantly lower than RMS for this Land Bridge option.

Overall there is no apparent difference in the estimates, although the estimates include substantially different overall contingency of 45% and 73% for Evans & Peck and RMS respectively.

4.3.5 Howarth Street

From Table 19 below the apparent difference in construction cost is less than 5% and is not considered significant.

Public utilities and property represents the two largest elements of apparent cost variance for this option. After adjusting for a 100% contingency provision in the RMS estimate, the difference in property costs is minor. Evans & Peck's estimate for utilities is substantially higher than the RMS estimate due to additional utility adjustments identified including those between Cutler Drive and Johns Road.

Overall the difference in estimates amounts to less than 1% of the RMS project cost (escalated to current pricing). Although producing similar project cost outcomes, the estimates by Evans & Peck and RMS include substantially different overall contingency of 45% and 71% respectively.

Table 19: Estimate Variance – Howarth Street

Howarth Street	RMS $2012 ($m)	E&P Adjusted ($m)	Difference ($m)	Difference % of RMS Total
Project Development	7.8	6.9	-0.9	-0.3%
Investigation and Design	13.0	11.9	-1.1	-0.3%
Property Acquisitions	38.9	21.5	-17.4	-5.3%
Public Utility Adjustments	30.8	59.1	+28.3	+8.6%
Construction of Works	237.6	227.8	-9.8	-3.0%
Handover	1.8	1.1	-0.7	-0.2%
TOTAL	**330**	**328**	**-2**	**-1%**

Notes

1. RMS estimated amounts have been cost adjusted to $(2012) terms.
2. Evans & Peck estimate is cost adjusted to compensate for scope difference - for comparison of route length of 5.1km from Johnson Road, Tuggerah to Johns Road, Wadalba.

4.3.6 Split-Level Carriageway

From Table 20 below the apparent difference in construction cost is $62 million and represents the largest element of cost variance for this option.

Table 20: Estimate Variance – Split-Level Carriageway

Split-Level Carriageway	RMS $2012 ($m)	E&P Adjusted ($m)	Difference ($m)	Difference % of RMS Total
Project Development	4.2	8.4	+4.2	+2.2%
Investigation and Design	6.1	13.7	+7.6	+2.9%
Property Acquisitions	31.3	23.5	-7.8	-4.0%
Public Utility Adjustments	29.6	45.9	+16.3	+8,4%
Construction of Works	123.2	185.2	+62.0	+31.8%
Handover	1.0	1.3	+0.3	+0.2%
TOTAL	**195**	**278**	**+83**	**+43%**

Notes

1. RMS estimated amounts have been cost adjusted to $(2012) terms.
2. Evans & Peck estimate.is cost adjusted to compensate for scope difference - for comparison of route length of 5.1km from Johnson Road, Tuggerah to Johns Road, Wadalba.

It appears that the RMS estimate has omitted scope and understated the construction cost, with large differences apparent in excavation costs and the cost of structures. Also the variance of $72 million in the RMS estimates for the Split-Level Carriageway and Land Bridge does not reflect the similarity of scope of these alternatives. RMS has omitted $12 million in property acquisition costs common to both alternatives, and for the Split-Level alternative has applied rates inconsistently,

including rates for pavements and structures up to 40% less than other through-town alternatives despite commonality of scope.

The differences are also scope related with RMS including costs for a new commuter car park and Evans & Peck including additional allowances for:

- reconstruction work around the Rose Street Bridge;
- full reconstruction of the existing pavements; and
- a new four lane bridge with shared cycle-way to replace the existing rail overbridge (in lieu of widening the existing structure as in the RMS estimate).

Overall the apparent difference in the estimates amounts to a very significant 43% of the RMS project cost (escalated to current pricing). The estimates by Evans & Peck and RMS include a difference in overall contingency of 39% and 74% respectively. However the RMS estimate is considered by Evans & Peck to be unreliable given the differences in scope and rates applied for this alternative, and the actual variance from Evans & Peck's estimate is likely to be substantially less than the $83 million indicated in Table 20.

4.3.7 RMS Preferred Option – Widened Carriageway

From Table 21 below the apparent difference in construction cost is $29 million. However Evans & Peck identified an error in the RMS estimate in the order of $20 million in construction costs (before contingency). In the calculation of indirect construction costs the estimate spreadsheet includes an incorrect double count of indirect costs, thereby overstating the P90 estimate. After adjusting for this error, the apparent variance in construction cost is reduced to less than $1 million.

The RMS estimate appears to calculate excavated volumes as the difference between the MX surface levels in the design model and existing surface levels. This method understates the volume of earthworks including material replacement.

Table 21: Estimate Variance – RMS Preferred Option Widened Carriageway

RMS Preferred Option Widened Carriageway	RMS $2012 ($m)	E&P ($m)	Difference ($m)	Difference % of RMS Total
Project Development	3.1	4.3	+1.2	+0.8%
Investigation and Design	8.5	7.1	-1.4	-0.9%
Property Acquisitions	10.0	12.1	+2.1	+1.4%
Public Utility Adjustments	12.6	23.6	+11.0	+7.1%
Construction of Works	119.4	90.3	-29.1	-18.8%
Handover	1.0	0.7	-0.4	-0.3%
TOTAL	**155**	**138**	**-17**	**-10%**

Notes

1. The Widened Carriageway estimate represents scope from Johnson Road, Tuggerah to Cutler Drive.
2. No adjustment required to cost estimates – both estimates prepared in 2012

Including adjustment for the $20 million error noted above, the RMS project cost reduces to approximately $127 million and the difference to +$11 million. Overall the difference in estimates is less than 10% of the amended RMS project cost (escalated to current pricing). Although producing similar project cost outcomes, the estimates by Evans & Peck and RMS include differences in overall contingency provisions of 35% and 49% respectively.

4.4 Conclusion

The RMS initial estimates have been prepared using a different approach to Evans & Peck. Notwithstanding the differences in approach and the limited design information for the strategic corridor options, the differences of 10% and 2% for the Eastern and Western Corridor estimates respectively are remarkably low.

With the exception of the Split-Level Carriageway, the Evans & Peck and RMS estimates for the through town alternatives, after adjusting for the full corridor length, are also similar and within 10%. The RMS estimate for the Split-Level Carriageway is not considered sufficiently reliable for comparison purposes.

The different scope initially estimated by Evans & Peck for the through-town alternatives from Johnson Road to Cutler Drive (2.1km) in lieu of the scope of the RMS estimates from Johnson Road to Johns Road (5.1km), has led to the comparison and identification of cost variances being more complex. Evans & Peck has not attempted to deduct scope and cost from the RMS estimates to facilitate comparison. Instead Evans & Peck has added costs of additional scope to the through town estimates for the purpose of comparison and variance analysis over the 5.1km route length.

More generally the RMS estimates have included higher contingency allowances where project scope is not well defined, while Evans & Peck has endeavoured to define scope to the extent possible and adopt lower contingency provisions.

5 Corridor Options 2006

5.1 Overview

This section responds to the terms of reference requirement to ratify or otherwise the advantages and disadvantages for each of the three corridor options investigated by RMS up to 2006. The three corridor options are:

1. Eastern Corridor (Bypass);
2. Western Corridor (Bypass); and
3. Central Corridor.

The options are described in the RMS documents Traffic Report - May 2005, Community Update - October 2006 and the *Community Consultation Report - September 2007*. The advantages and disadvantages examined for this review are taken from the *Options Study - October 2006*.

In responding to the requirement to ratify or otherwise the advantages and disadvantages, Evans & Peck understands ratify to mean,

> *"to sign or give formal consent to (a treaty, contract, or agreement), making it officially valid".*

Evans & Peck's approach to ratifying the RMS advantages and disadvantages of the corridor options has been to provide a position in regard to the statements made, as either:

(a) agreement;

(b) qualified agreement;

(c) disagreement; or

(d) advise where there is insufficient information to form a view.

Evans & Peck has relied on the information contained in the supporting RMS technical documents to validate the statements made by RMS, and has not undertaken any further technical studies of its own (i.e. design, traffic modelling, or environmental investigation).

5.2 Eastern Corridor

5.2.1 Advantages of an Eastern Corridor

- *Shortest option for through traffic using the Pacific Highway to Sparks Road*
  - ***Agree***

On the alignment proposed, the overall length of the Eastern Corridor is 4.5km from Johnson Road intersection at Tuggerah in the south to the roundabout intersection of Pacific Highway and Johns Road at Wadalba in the north. This is the shortest of the three corridor options. All corridor options terminate at the Johns Road roundabout, which is the closest point to Sparks Road.

- *Heritage buildings in Wyong would be remote from construction*
  - ***Agree***

The Heritage Buildings located on the existing Pacific Highway in Wyong town centre would be more than 0.5km from the construction works for an Eastern Bypass, assuming no upgrading of the highway through the town centre.

- *Low impact on traffic during construction*
  - ***Do not agree***

Construction of an Eastern Corridor option has potential to significantly impact on traffic during construction.

Potential for southbound traffic to queue back through the Wyong town centre is high caused by restrictions on traffic during construction of the Johnson Road roundabout and other changes necessary to the Johnson Road-Pacific Highway intersection. The traffic management issues will be significant and require careful consideration if the impact on Pacific Highway traffic is to be minimised. Temporary works at the Johnson Road roundabout and the Johnson Road-Pacific Highway intersection area may require specific design solutions with traffic modelling to ensure impact on traffic through Wyong is minimised.

There may be an impact on local traffic in the East Wyong local area where much of the Eastern Bypass would be constructed, with traffic diverting to Warner Avenue and Pollock Avenue.

When considered in relative terms, traffic impact during construction is likely to be lower for the Eastern Corridor than for the Central Corridor, due simply to the higher volume of Pacific Highway traffic being affected by construction over the full 5km length of the Central option.

5.2.2 Disadvantages of an Eastern Corridor

- *Approximately 80 properties (including at least 60 dwellings) would need to be acquired to establish the new corridor.*
  - ***Agree with qualification***

Based on the proposed route defined by RMS, Evans & Peck estimates approximately 28 residential properties, 16,000m2 of commercial property, 3,500m2 of government property and 285,000m2 of rural and farm land will be acquired for the Eastern Corridor option. Clearly the number of properties to be acquired is significant and broadly comparable with RMS estimate of 80 properties. This estimate will require confirmation following preparation of a concept design for the Eastern Corridor.

- *Increased traffic noise levels in areas where there is currently little traffic noise.*

  Measures to lessen the impact of noise would be proposed for properties that experience a significant increase in noise levels.
  - ***Agree with qualification***

This statement could be considered valid as stated however it is too general for assessment of noise impact. Whilst there is limited traffic data and no information provided for noise impacts, intuitively it is likely that an increase in traffic volume to 11,000 vehicles per day (RMS Options Study 2006) along the Eastern Corridor will generate increased noise for East Wyong residents. Mitigation measures for road traffic noise will be required in accordance with RMS policy if an Eastern Bypass were constructed. Predictive noise modelling or assessment of noise impact is not available for this review.

- *Potential impacts on indigenous heritage items along the banks of the Wyong River.*
  - ***Insufficient information***

There is no Indigenous Heritage impact assessment available for this review. Evans & Peck is unable to verify the existence of potential indigenous heritage items along the Wyong River bank.

- *Potential impacts on sensitive environmental protection zones, including the SEPP 14 wetlands.*
  - ***Agree***

The Eastern Corridor will have an impact on SEPP 14 wetlands. Mitigation measures will be required. The significance of this impact will require assessment. There is no Wetland Impact assessment available for this review. Evans & Peck cannot verify the extent of this impact however agree there will be potential impact on sensitive environmental protection zones, including SEPP 14 Wetlands, if an Eastern Bypass were constructed.

- *Potential impacts on flora and fauna in the vicinity of the Wyong River.*
  - ***Agree***

The Eastern Bypass option will have potential impact on flora and fauna in the vicinity of the Wyong River. The significance of this impact will require assessment. There is no Flora and Flora Impact assessment available for this review. Evans & Peck cannot verify the extent of this impact however agrees there will be potential impact on flora and fauna, if an Eastern Bypass were constructed.

- *Residential areas in Wyong could be divided by the corridor.*
  - ***Agree***

An Eastern Corridor will change the character of the surrounding residential areas in East Wyong. However well-planned urban design detailing incorporating improved road design, appropriate traffic management, lighting, landscaping, shared pedestrian and cycle paths together with environmental mitigation measures may effectively limit any dividing effect. There is insufficient information for Evans & Peck to form a view on the likely degree of division of residential areas.

- *It may still be necessary to upgrade the road through the town centre within 15 years for local traffic.*
  - ***Insufficient information***

Traffic studies will be necessary to assess the model predictions and the needs for any future road upgrade requirements. The supporting traffic models require an update to reflect the arrangements used in current proposals (number of lanes, intersection details etc.) and predict future traffic demand. Evans & Peck are unable to form a view as to the disadvantage associated with potential future local road upgrades. The responsibility for the existing Pacific Highway through the town centre will revert to Wyong Shire Council if a bypass option is adopted. This would effectively transfer the obligation for upgrading the existing Pacific Highway in future years from RMS to Council.

There is conflicting information and insufficient traffic modelling to support the statement predicting the necessity for an upgrade to the existing Pacific Highway through Wyong should an Eastern Bypass be constructed. This assessment by RMS assumes traffic will divert through the town centre via a proposed link (Railway Road), however this link road is not yet confirmed by planning.

- *The estimated cost is the second most expensive option.*
  - ***Agree with qualification***

The preliminary cost estimate guidance provided by RMS in the Options Study 2006, ranked from low to high is:

1. Central Corridor $100M - $200M
2. Eastern Corridor $150M - $250M
3. Western Corridor $200M - $350M

Based solely on this preliminary cost information RMS concluded that the Eastern Corridor is the second most expensive of the three options. However these are strategic level estimates with significant contingency amounts reflecting the uncertainty of scope at the early stage of development.

Comparing RMS cost estimates from 2006 provided for this review, the Eastern Corridor again ranks second of the 2006 corridor options, as follows:

1. Through-town alternative Split-Level Carriageway $146M (including 74% contingency)
2. Eastern Corridor $197M (including 90% contingency)
3. Western Corridor $312M (including 92% contingency)

Comparing the independent cost estimates prepared by Evans & Peck for this review, the corridor options ranking is:

1. Central Corridor $280 million. (including 45% contingency)
2. Eastern Corridor $290 million (including 50% contingency)
3. Western Corridor $410 million (including 50% contingency)

At strategic estimate level, the costs for the Eastern and Central Corridors are close and should be considered similar. On this basis the Eastern Corridor ranks equal lowest cost, and accordingly Evans & Peck is not in a position to agree definitively that an Eastern Corridor is the second most expensive option.

Further development of concept design detail and traffic modelling for each corridor option would confirm scope, road usage and road user benefits, environmental impact and mitigation measures required, and the impact on property, and may change the corridor options cost ranking.

In summary, Evans & Peck broadly agrees with 50% of the RMS assessment for the Eastern Corridor, as detailed in Table 22.

Table 22: Eastern Corridor – Advantages and Disadvantages

Evans & Peck's Assessment	RMS – Advantages and Disadvantages
Agree	+ Shortest option for through traffic using the Pacific Highway to Sparks Road. + Heritage buildings in Wyong would be remote from construction. – Potential impacts on sensitive environmental protection zones, including the SEPP 14 wetlands. – Potential impacts on flora and fauna in the vicinity of the Wyong River. – Residential areas in Wyong could be divided by the corridor.
Agree with Qualification	– Approximately 80 properties (including at least 60 dwellings) would need to be acquired to establish the new corridor. – Increased traffic noise levels in areas where there is currently little traffic noise. Measures to lessen the impact of noise would be proposed for properties that experience a significant increase in noise levels. – The estimated cost is the second most expensive option.
Insufficient Information	– Potential impacts on indigenous heritage items along the banks of the Wyong River. – It may still be necessary to upgrade the road through the town centre within 15 years for local traffic.
Do not Agree	+ Low impact on traffic during construction.

5.3 Western Corridor

5.3.1 Advantages of a Western Corridor

- *Heritage buildings in Wyong would not be affected by construction*
  - ***Agree***

The Heritage Buildings located on the existing Pacific Highway in Wyong town centre would be more than 0.5km from the construction works for a Western Corridor, assuming no upgrading of the highway through the town centre.

- *Low impact on traffic during construction*
  - ***Do not agree***

Construction of a Western Bypass could have a significant impact on traffic during construction. Road works and the construction of a new four-lane bridge over the rail line at Watanobbi may cause an impact on traffic. Construction of the section from Watanobbi to Wadalba will have an impact on local traffic and through traffic together with access to property.

Potential for traffic to queue back through the Wyong town-centre is high in the PM peak caused by restrictions on traffic during construction of the Watanobbi to Wadalba section. There will be impacts on property access and local traffic in this section.

When considered in relative terms, traffic impact during construction is likely to be lower for the Western Corridor than for the Central Corridor, due simply to the higher volume of Pacific Highway traffic being affected by construction over the full 5km length of the Central option.

- *Potential for a new link to the F3 Freeway if an additional interchange were constructed.*
  - ***Insufficient information***

RMS advise that planning for the F3 Freeway is not dependent on any proposed upgrade to the adjacent road network or vice-versa, and there is no current proposal to provide an additional F3 interchange in the vicinity of Alison Road. In the absence of planning or traffic modelling data, Evans & Peck cannot verify with any certainty whether constructing an additional interchange at Alison Road will provide any advantage of a new link to the F3 Freeway in the future.

5.3.2 Disadvantages of a Western Corridor

- *Approximately 130 properties (including at least 90 dwellings) would need to be acquired to establish the new corridor.*
  - ***Agree with qualification***

Based on the proposed route defined by RMS, Evans & Peck estimates approximately 56 residential properties, 37,920 m^2 of commercial property, 4,550 m^2 of government property and 268,000 m^2 of rural and farm land that will be required for the Western Corridor option. Clearly the number of properties to be acquired is significant and broadly comparable with RMS estimate of 130 properties. This estimate will require reconfirmation following preparation of a concept design for the Western Corridor.

- *Increased traffic noise levels in areas where there is currently little traffic noise.*

  Measures to lessen the impact of noise would be proposed for properties that experience a significant increase in noise levels.
  - ***Agree with qualification***

This statement could be considered valid as stated, however it is too general for assessment of noise impact. Whilst there is limited traffic data and no information provided for noise impacts, intuitively it is likely that an increase in traffic volume to 5,000 vehicles per day (RMS *Options Study 2006*) along the Western Corridor will generate increased noise for Watanobbi and Wyong's western perimeter residents. Mitigation measures for road traffic noise will be required in accordance with RMS policy if a Western Corridor option is constructed, although reduced somewhat by the tunnel option considered by RMS for Watanobbi. Predictive noise modelling or assessment of noise impact is not available for this review.

- *Potential impacts on indigenous heritage items along the banks of the Wyong River.*
  - ***Insufficient information***

There is no Indigenous Heritage impact assessment available for this review.

Evans & Peck is unable to verify the existence of potential indigenous heritage items along the Wyong River bank.

- *Potential impacts on flora and fauna in the vicinity of the Wyong River.*
  - ***Agree***

The Western Corridor option will have potential impact on flora and fauna in the vicinity of the Wyong River. The significance of this impact will require assessment. There is no Flora and Flora Impact assessment available for this review. Evans & Peck is unable to verify the extent of this impact however agrees there will be impact on flora and fauna, if a Western Bypass were constructed.

- *Potential impacts on the Wyong River floodplain. The highway would need to be built on a high embankment, which could change the flooding characteristics of the river*
  - ***Agree with qualification.***

The Western Bypass will impact the Wyong River floodplain by virtue of the proximity of the proposed alignment and bridge crossing of Wyong River, and may impact hydrology and flooding characteristics of the river particularly if constructed on embankment. However hydrological impact assessment is not available for this review. In the absence of concept design detail or specialist hydrological studies Evans & Peck is unable to verify the implications for the floodplain or the effect on flooding characteristics.

- *If a connection to the F3 Freeway were to be provided, east-west traffic volumes through Wyong Township would increase*
  - ***Agree***

Evans & Peck agree a connection to the F3 Freeway at Alison Road could increase east-west traffic volumes through Wyong. This statement is confirmed in the RMS *Traffic Report May 2005.*

- *The residential suburb of Watanobbi could be divided into two distinct areas by the corridor if a tunnel is not built. If a tunnel is built, ventilation stacks may be required.*
  - ***Agree***

Evans & Peck agree a Western Corridor option would have a significant impact on the residential area of Watanobbi, based on a proposed alignment west of the Britannia Drive roundabout. The alternative tunnel option at Watanobbi would mitigate to some degree the division of the residential area, depending on the length of tunnel and location of portals. Provision of ventilation stacks would be dependent on the tunnel design and length, and potentially may be avoided by exhausting at the tunnel portals. A tunnel option at Watanobbi is not included in the Evans & Peck cost estimate for the Western Corridor.

- *This is the longest corridor and would attract the lowest traffic volume.*
  - ***Agree***

On the alignment proposed by RMS, the 6.9km Western Corridor from Johnson Road in the south to the Johns Road roundabout in the north is the longest of the three corridor options.

Traffic volumes predicted by RMS in the *Options Study May 2006* are:

- Western Corridor 5,000 vpd
- Eastern Corridor 11,000 vpd
- Central Corridor 25,000 vpd

From these figures, RMS concludes that the Western Corridor attracts the lowest predicted traffic volumes. Evans & Peck has not sighted RMS traffic model data to confirm the underlying assumptions and inputs. The *Traffic Report May 2005* contains modelling and predicted traffic volumes for each corridor option that are not consistent with the RMS conclusion above. The report concludes that:

'Both bypass options would significantly reduce traffic on Pacific Highway through Wyong Town Centre.'

The supporting RMS traffic reports and modelling require updating to reflect the arrangements in current proposals (number of lanes, intersection configurations etc.) and predict future traffic demand including local traffic.

- *It may still be necessary to upgrade the road through the town centre within 10 to 15 years for local traffic.*
  - ***Insufficient information***

There is insufficient information and traffic modelling to support the statement predicting the necessity for an upgrade to the existing Pacific Highway through Wyong should a Western Bypass be constructed. The assessment by RMS assumes traffic using a proposed link along Railway Road, will continue to use the existing through town alignment in preference to the Western Corridor, however this link is not yet confirmed by planning.

The responsibility for the existing Pacific Highway through the town centre will revert to Wyong Shire Council if a bypass option is adopted. This would effectively transfer the obligation for upgrading the existing Pacific Highway in future years from RMS to Council.

- *This is the most expensive option, with an estimated cost of $200-$300 million.*
  - ***Agree***

The preliminary cost estimate guidance provided by RMS in the Options Study 2006, ranked from low to high is:

1. Central Corridor $100M - $200M
2. Eastern Corridor $150M - $250M
3. Western Corridor $200M - $350M

Based solely on this preliminary cost information RMS concluded that the Western Corridor is the most expensive of the three options. However these are strategic level estimates with significant contingency amounts reflecting the uncertainty of scope at the early stage of development.

Comparing RMS cost estimates from 2006 provided for this review, the Western Corridor again ranks third of the 2006 corridor options, as follows:

1. Through-town alternative Split-Level Carriageway $146M (including 74% contingency)
2. Eastern Corridor $197M (including 90% contingency)
3. Western Corridor $312M (including 92% contingency)

Comparing the independent cost estimates prepared by Evans & Peck for this review, the corridor options ranking is:

1. Central Corridor $280 million (including 45% contingency)
2. Eastern Corridor $290 million (including 50% contingency)
3. Western Corridor $410 million (including 50% contingency)

From all three comparisons the Western Corridor ranks highest cost, and accordingly Evans & Peck agrees that a Western Corridor is the most expensive option.

- *The option has higher costs than benefits to the community.*
  - ***Insufficient Information***

As RMS has not provided a cost benefit analysis for the Western Corridor, Evans & Peck is unable to confirm whether this option delivers higher costs than benefits to the community.

In summary, Evans & Peck broadly agrees with more than 60% of the RMS assessment for the Western Corridor, as detailed in Table 23.

Table 23: Western Corridor - Advantages and Disadvantages

Evans & Peck's Assessment	RMS – Advantages and Disadvantages
Agree	+ Heritage buildings in Wyong would not be affected by construction. – Potential impacts on flora and fauna in the vicinity of the Wyong River. – If a connection to the F3 Freeway were to be provided, east-west traffic volumes through Wyong Township would increase. – The residential suburb of Watanobbi could be divided into two distinct areas by the corridor if a tunnel is not built. If a tunnel is built, ventilation stacks may be required. – Potential impacts on flora and fauna in the vicinity of the Wyong River. – This is the longest corridor and would attract the lowest traffic volume. – This is the most expensive option, with an estimated cost of $200-$300M.
Agree with Qualification	– Approximately 130 properties (including at least 90 dwellings) would need to be acquired to establish the new corridor. – Increased traffic noise levels in areas where there is currently little traffic noise. Measures to lessen the impact of noise would be proposed for properties that experience a significant increase in noise levels. – Potential impacts on the Wyong River floodplain. The highway would need to be built on a high embankment, which could change the flooding characteristics of the river
Insufficient Information	+ Potential for a new link to the F3 Freeway if an additional interchange were constructed. – Potential impacts on indigenous heritage items along the banks of the Wyong River. – It may still be necessary to upgrade the road through the town centre within 10 to 15 years for local traffic. – The option has higher costs than benefits to the community
Do not Agree	+ Low impact on traffic during construction.

5.4 Central Corridor

5.4.1 Advantages of a Central Corridor

- *Utilises existing infrastructure by using the existing Pacific Highway road reserve.*
  - ***Agree***

Evans & Peck agrees that establishing a new corridor with either the Eastern or Western Corridor options will be a significant planning issue and there is an advantage in using existing infrastructure within the available road reserve. Key elements of the existing infrastructure would also be upgraded or replaced including duplication of the bridge over Wyong River and potential widening or duplication of the bridge over the rail line (east of Britannia Drive roundabout).

- *Property acquisition minimised as corridor uses the existing road reserve.*
  - ***Agree***

Evans & Peck agree property acquisition is minimised with the adoption of a Central Corridor as the alignment adopted for the Options Study 2006 follows the existing road reserve and avoids residential areas. Unlike the Eastern and Western Corridors, RMS has not quantified the number of properties or dwellings impacted by a widening of the road reserve, which prevents a direct quantitative comparison. However acquisition plans provided for the Widened Carriageway (through-town alternative) indicate the central corridor will impact some businesses in the town centre including the Warner Shops and Station Masters Cottage, with widening of the road reserve predominantly to the east of the existing alignment. Elsewhere private dwellings are unlikely to be impacted.

The road reserve will need to be widened for the section between Watanobbi and Wadalba further impacting on property. Further land may be required for the bridge over the northern railway line.

- *Additional noise levels are not transferred to existing residential areas.*
  - ***Agree***

Although predictive noise modelling or assessment of noise impact is not available for this review, there is expected to be noise impact assessment required where the Central Corridor is adjacent to existing residential areas, in particular from Cutler Drive to Britannia Drive. Elsewhere the additional noise from increased traffic volumes on a Central Corridor would be unlikely to significantly impact the more remote residential areas in Watanobbi, East Wyong, or the western perimeter of Wyong. Accordingly Evans & Peck concurs that the additional traffic noise will not be transferred to these areas under this option.

- *No impact on environmental protection zones and floodplains.*
  - ***Agree***

Based on the environmental protection zones identified in Figure 2 of the Options Study 2006, there appears to be no impact on those zones from the Central Corridor alignment. Assuming the bridge duplication proposed over Wyong River is designed to not exacerbate flooding of the river, Evans & Peck does not expect the Central Corridor alignment to impact on the floodplains.

- *Opportunity to enhance the town centre through good urban design solutions.*
  - ***Agree***

RMS has previously demonstrated its capability to deliver good urban design outcomes in town centres to complement major road upgrades, including in the Blue Mountains region on Great Western Highway. Evans & Peck considers the opportunity exists for Wyong town centre to benefit from enhancement through urban design solutions.

- *Construction of the highway upgrade can be undertaken in stages.*
  - ***Agree***

The advantage of staging construction of the upgrade is to maintain through traffic movements, maintain access to businesses in the town centre, and maintain functionality of the transport interchange at Wyong train station. Whilst construction staging will require careful planning to minimise impacts, there are various alternatives available for staging the works dependent on the final design solution adopted for the Central Corridor.

- *This is the least expensive option.*
  - ***Agree with qualification***

The Evans & Peck estimate for the Central Corridor is $280 million whereas the Eastern Corridor option is $290 million. The contingency amounts are 46% and 50% respectively. At strategic estimate level, these estimates are close and should be considered similar. Evans & Peck are not in a position to agree a Central Corridor is the least expensive option. Further investigation work will be required, in particular with the Eastern Corridor to confirm concept design detail, traffic modelling, effect on property, environmental impact and mitigation measures required before a definitive position can be stated in regard to relative cost between an Eastern and Central Corridor option.

The preliminary cost estimate guidance provided by RMS in the Options Study 2006, ranked from low to high is:

1. Central Corridor $100M - $200M
2. Eastern Corridor $150M - $250M
3. Western Corridor $200M - $350M

Based solely on this preliminary cost information it is likely that the Central Corridor is the least expensive of the three options.

Comparing RMS cost estimates from 2006 provided for this review, the Central Corridor again ranks first of the 2006 corridor options, as follows:

1. Through-town alternative Split-Level Carriageway $146M (including 74% contingency)
2. Eastern Corridor $197M (including 90% contingency)
3. Western Corridor $312M (including 92% contingency)

Comparing the independent cost estimates prepared by Evans & Peck for this review, the corridor options ranking is:

1. Central Corridor $280 million (including 45% contingency)
2. Eastern Corridor $290 million (including 50% contingency)
3. Western Corridor $410 million (including 50% contingency)

At strategic estimate level, the costs for the Eastern and Central Corridors are close and should be considered similar. On this basis the Central Corridor ranks equal lowest cost, and accordingly Evans & Peck is not in a position to agree definitively that a Central Corridor is the least expensive option.

5.4.2 Disadvantages of a Central Corridor

- *Potential impacts on the connection between the commercial area and the railway station.*
  - ***Do not agree***

A Central Corridor option would not significantly impact the connectivity between the commercial area and the railway station, more than the existing Pacific Highway which currently separates the two areas. Evans & Peck expect sufficient crossing opportunities will be provided by RMS as part of an integrated urban design solution for any through town alternative developed in consultation with the community and stakeholders. Evans & Peck are not in a position to assess whether the final design adopted will negatively impact on the connection between the commercial area and the railway station, but expect any impact to be mitigated by good design.

- *Potential reduction of on-street and commuter parking.*
  - ***Agree***

There is likely to be a reduction in on-street and commuter car parking due to the impact of a widened Central Corridor alignment on the existing parking area adjacent to Wyong Railway Station. However subsequent studies undertaken for the *Business Impact Assessment – December 2010* indicate this reduction will not be significant,

- *Potential visual impact on the township and heritage buildings.*
  - ***Agree***

The Central Corridor option will have a visual impact on the township, by virtue of the widened footprint of the highway. Evans & Peck expect the Station Masters Cottage and Warner Shops heritage buildings may also be visually impacted if they are modified, relocated or removed from the current site to accommodate the Central Corridor option.

- *Existing palm trees may need to be relocated.*
  - ***Agree***

The existing palm trees are within the footprint of the Central Corridor widening and would be expected to be temporarily relocated during construction of the upgrade. The palm trees could be replanted if required as a feature of the final landscaping and urban design solution.

- *The prominence and context of heritage items within the town centre could be affected.*
  - ***Agree***

Evans & Peck acknowledge that whilst the Eastern and Western Corridor options are unlikely to affect the heritage buildings in Wyong, all Central Corridor alternatives will impact the Station Masters Cottage and the Warner Shops to varying degrees.

Evans & Peck considers the study *Heritage Study and Assessment of Relocation Costs for RTA - January 2011* underestimates the possible impact of construction on these heritage properties, overestimates the ease of relocation, and understates the likely cost. Evans & Peck recommend further investigation, based on site inspection, survey, road safety audit and structural assessment, be undertaken as a basis for ongoing evaluation of options.

In summary, Evans & Peck agrees with most of the RMS assessment for the Central Corridor, as detailed in Table 24.

Table 24: Central Corridor – Advantages and Disadvantages

Evans & Peck's Assessment	RMS – Advantages and Disadvantages
Agree	+ Utilises existing infrastructure by using the existing Pacific Highway road reserve. + Property acquisition minimised as corridor uses the existing road reserve. + No impact on environmental protection zones and floodplains. + Opportunity to enhance the town centre through good urban design solutions. + Construction of the highway upgrade can be undertaken in stages. – Potential reduction of on-street and commuter parking. – Potential visual impact on the township and heritage buildings. – Existing palm trees may need to be relocated. – The prominence and context of heritage items within the town centre could be affected. + Additional noise levels are not transferred to existing residential areas.
Agree with Qualification	+ This is the least expensive option.
Do not Agree	– Potential impacts on the connection between the commercial area and the railway station.

5.5 Conclusion

In the process of evaluating the advantages and disadvantages of the corridor options, Evans & Peck have observed the following matters that may warrant further consideration when assessing the merits of the corridor options:

5.5.1 Design

In the absence of sufficient detail to provide cost estimates, in particular the scope for the Eastern and Western Corridor options, scope for each corridor option was developed by examining the supporting documents, the diagrams provided overlaid on aerial photographs and discussions held with RMS to define how each corridor option should be established. The scope was established by qualitative methods and will need confirmation with design study, in particular the Eastern Corridor option.

Evans & Peck's position with respect to the advantages and disadvantages listed in this section is dependent upon the clarity of scope and the relevance of the supporting technical studies. The supporting technical studies need to be updated to reflect the scope developed for this review and included in the Evans & Peck cost estimates.

5.5.2 Traffic

The analysis reported in the RMS *Traffic Report May 2005* appears inconsistent with statements in the *Options Study October 2006* regarding traffic volumes, in particular that low traffic volumes would be attracted to the bypass corridors leaving considerable congestion through the township.

The *Traffic Report May 2005* predicts significantly different traffic numbers in both the morning (AM) and afternoon (PM) peak for the Eastern, Western and Central Corridor options to those presented in the *Options Study 2006*. For example, the traffic modelling for the Eastern Corridor predicts for 2011 PM peak,

- base case 1,057 vehicles per hour;
- 341 vehicles would use the town centre route; and
- 1,109 would use the Eastern Corridor.

The *Traffic Report* also states:

- *Both bypass options would significantly reduce traffic on Pacific Highway through Wyong Town Centre. This would result in reduced delay at intersections; and*
- *Modelled travel times indicate substantial benefits for through traffic on the Eastern Bypass but only limited reduction on the Western Bypass.*

Notwithstanding the predicted traffic volumes, the *Traffic Report* is based on:

- the Eastern and Western Corridor options as a two-lane, two-way road (i.e. one lane in each direction);
- the Central Corridor as four lanes (two lanes in each direction) between Johnson Road and Johns Road, Wadalba; and
- an at-grade intersection with Alison Road on the Western Corridor.

The *Traffic Report May 2005* appears inconsistent with the corridor options now under consideration and as such Evans & Peck cannot rely on the information contained to support agreement with the traffic predictions in the *Options Study 2006*, in particular advantages associated with predicted traffic volumes, traffic growth and the future need to upgrade sections of the local road network.

5.5.3 Cost

Evans & Peck is not able to validate clear advantages or disadvantages associated with each of the corridor options until clarity of design and traffic analysis has been established and confirmed as the basis for the cost estimates.

5.5.4 Environmental Impact

The statements in the *Options Study October 2006* referring to potential environmental impacts on flora and fauna, archaeological and sensitive wetlands are not able to be verified by Evans & Peck, as the relevant technical studies are not available for review. Evans & Peck has assumed RMS will undertake these environmental studies (desktop with subsequent field inspection if appropriate) to confirm the potential impacts identified.

5.6 Recommendations

To improve the certainty of the RMS cost estimates and confirm RMS' assessment of the advantages and disadvantages of the three corridor options, Evans & Peck offer the following recommendations:

- Further investigation is undertaken to confirm the feasibility of the concept designs, in particular the concept design for the Eastern Corridor;
- Further investigation is undertaken to update the traffic models that predict the distribution and volumes of traffic;
- Further investigation is undertaken to confirm the impact on property, as this cost is a significant component of total project cost, in particular for an Eastern Corridor;
- Further investigation is undertaken to confirm the existence of environmental impacts associated with the proposals, in particular the Eastern Corridor;
- Upon refinement of the updated scope and confirmation of the predicted traffic, estimates and programs are developed to clearly define the best outcome for the corridor route selection study;
- Prepare a Project Appraisal Report including the road user benefits and costs for the selected options; and
- Undertake a comprehensive risk analysis and quantitative risk assessment.

6 Through-Town Alternatives – 2008

6.1 Overview

This section responds to the terms of reference requirement to ratify or otherwise the qualitative comparison of the five through-town options investigated by RMS up to 2008. Evans & Peck has provided commentary on the RMS comparison and indicated agreement or disagreement with the RMS assessment as appropriate, by specific reference to the supporting technical investigations which substantiate the comparison by RMS. Evans & Peck has not undertaken to validate the qualitative comparison by RMS.

The five through-town alternatives for the Pacific Highway Upgrade through the Wyong Town Centre are:

1. a tunnel under the existing highway;
2. a land bridge just below the existing highway alignment;
3. an alignment using Howarth Street for the southbound carriageway;
4. a Widened Existing Carriageway; and
5. a Split-Level Carriageway on the existing highway alignment.

The Central Corridor Option with widening of the existing carriageway is the RMS preferred alternative as documented in the *Options Study Report, July 2008* and as further refined in the *Community Update, November 2011*.

The process followed by Evans & Peck in this evaluation of the RMS qualitative comparison was to:

a) Develop independent estimates of cost for each alternative;

b) Review the technical investigations and data provided by RMS in support of the project;

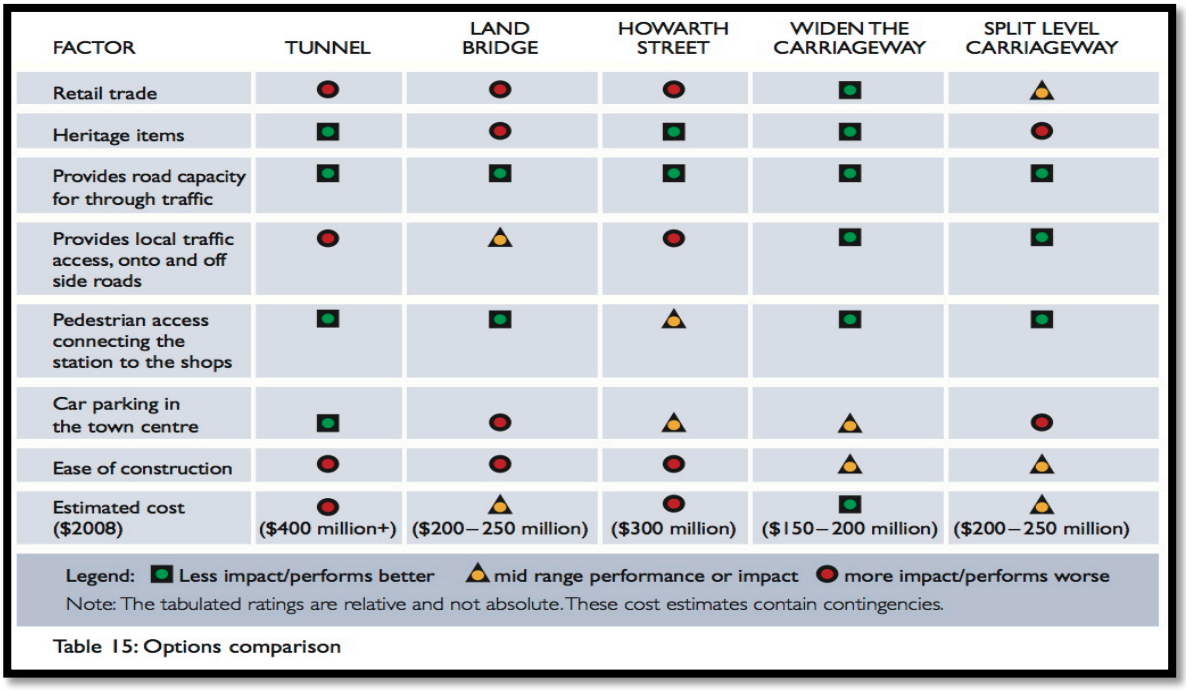
c) Provide an independent review of the qualitative comparisons by reference to the data collected and the content of the technical investigations undertaken; and

d) Confirm agreement or otherwise with the RMS assessment.

The assessment criteria developed by RMS to compare alternatives are:

- Retail trade, including maintaining access during construction;
- Heritage issues, including minimising impact on heritage items and costs to avoid;
- Traffic capacity and network implications;
- Vehicle and pedestrian access connectivity and severance;
- Car parking within the Town Centre; and
- Ease of construction, staging complexity, duration, and impacts.

The conclusions reached by RMS and published in Table 15 of the *Options Study Report, July 2008* are reproduced in Figure 5 below.



FACTOR	TUNNEL	LAND BRIDGE	HOWARTH STREET	WIDEN THE CARRIAGEWAY	SPLIT LEVEL CARRIAGEWAY
Retail trade	●	●	●	■	▲
Heritage items	■	●	■	■	●
Provides road capacity for through traffic	■	■	■	■	■
Provides local traffic access, onto and off side roads	●	▲	●	■	■
Pedestrian access connecting the station to the shops	■	■	▲	■	■
Car parking in the town centre	■	●	▲	▲	●
Ease of construction	●	●	●	▲	▲
Estimated cost ($2008)	● ($400 million+)	▲ ($200–250 million)	● ($300 million)	■ ($150–200 million)	▲ ($200–250 million)

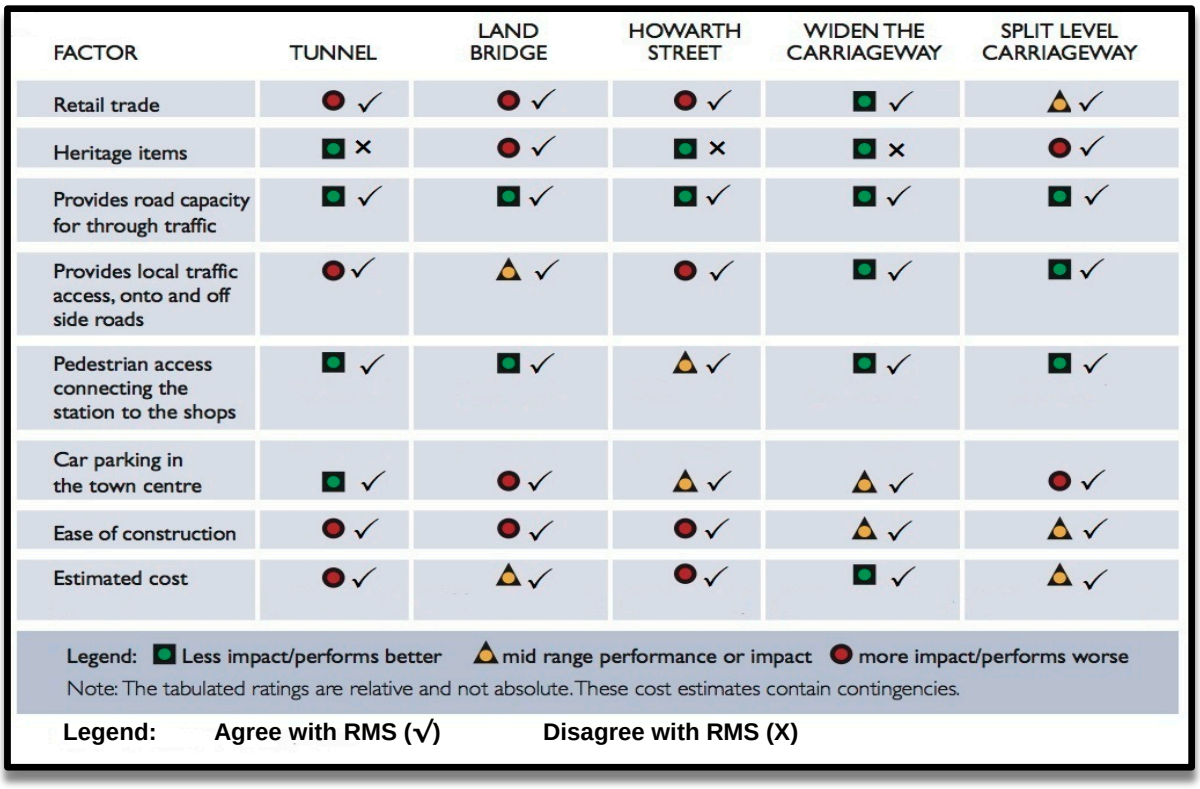
Legend: ■ Less impact/performs better ▲ mid range performance or impact ● more impact/performs worse
Note: The tabulated ratings are relative and not absolute. These cost estimates contain contingencies.

Table 15: Options comparison

Figure 5: Option Comparison Table, RMS Options Study Report July 2008

6.2 Summary of Evaluation

Evans & Peck's evaluation of alternatives against the RMS comparative criteria is summarised in Figure 6 below.



FACTOR	TUNNEL	LAND BRIDGE	HOWARTH STREET	WIDEN THE CARRIAGEWAY	SPLIT LEVEL CARRIAGEWAY
Retail trade	● ✓	● ✓	● ✓	■ ✓	▲ ✓
Heritage items	■ ×	● ✓	■ ×	■ ×	● ✓
Provides road capacity for through traffic	■ ✓	■ ✓	■ ✓	■ ✓	■ ✓
Provides local traffic access, onto and off side roads	● ✓	▲ ✓	● ✓	■ ✓	■ ✓
Pedestrian access connecting the station to the shops	■ ✓	■ ✓	▲ ✓	■ ✓	■ ✓
Car parking in the town centre	■ ✓	● ✓	▲ ✓	▲ ✓	● ✓
Ease of construction	● ✓	● ✓	● ✓	▲ ✓	▲ ✓
Estimated cost	● ✓	▲ ✓	● ✓	■ ✓	▲ ✓

Legend: ■ Less impact/performs better ▲ mid range performance or impact ● more impact/performs worse
Note: The tabulated ratings are relative and not absolute. These cost estimates contain contingencies.

Legend: Agree with RMS (√) Disagree with RMS (X)

Figure 6: Option Comparison Evans & Peck August 2012

6.3 Qualitative Comparison

The terms used in the RMS *Options Study Report – July 2008* to rank (or rate) the outcomes of the qualitative comparison are:

- *less* impact, performs better
- *mid-range* performance or impact,
- *more* impact, performs worse

These terms are understood by Evans & Peck to represent the relative level of impact between one individual alternative and the others. They do not represent any quantitative value or statement of impact significance.

The supporting project documents (as described in section 2.4.1 of this report) contain the outcome of various investigations relevant to some of the RMS assessment criteria. Not all assessment criteria or design alternatives are covered by the technical reports and investigations provided to Evans & Peck. The reports do not provide a comparative assessment of the alternatives. However they are the primary source of information available and provide insight into the relative impact of the various assessment criteria considered.

6.3.1 Retail Trade

RMS prepared a report which considers the impact on commercial activity in Wyong caused by the Widened Carriageway. The report, *Wyong, Pacific Highway Upgrade, Business Impact Assessment - December 2010* is the most relevant assessment of impact on retail business resulting from the upgrade project, to support the comparative evaluation. The report is based on the Widened Carriageway alternative only, and although it does not address the relative impact or performance of other through-town alternatives, it is the only information available to Evans & Peck focussing on the impact on local business.

The report includes the following comments regarding potential loss of trade:

> *'Notwithstanding its below average performance the level of trade that is dependent upon passing traffic is not a significant proportion of total trade.*'
>
> and;
>
> *'Total proportion of trade lost due to the upgrade works is no more than 3.5%. This is considered insignificant. Note that real growth in household and worker expenditure generated in the immediate locality would more than make good for the loss over a period of no more than 2-3 years.'*

In regard to parking impacts on trade, the report comments that:

> *'In the important mid-section between Church Street and Robley Lane a total of 21 car parking spaces will be retained on the western side of the highway and 30 spaces provided on the eastern side in a new car park. As a result we believe that no more than one third of the potential 8% loss in trade would result from the upgrade. In other words the Wyong Town Centre is highly unlikely to lose more than 2.5% in trade (total retail sales) post construction, which is considered insignificant.'*

Based on the *Business Impact Assessment* report findings, it appears there should be no major impact on retail trade, whichever through-town alternative is selected. Notwithstanding this conclusion, a significant temporary impact on local retail business is expected during construction of any through-town alternative and Evans & Peck supports the recommendations in the Business Impact Assessment report, to maintain access into the town centre via the Pacific Highway at all times, and maintain car parking spaces along the highway.

Post construction, the Widened Carriageway and to a lesser extent the Split-Level Carriageway alternative should provide better access to the Wyong retail outlets (relative to other through-town alternatives), and allow more opportunities for local traffic to stop.

Evans & Peck generally agrees with the RMS qualitative comparison against the retail trade criteria.

6.3.2 Heritage

The consultant reports, *Heritage Assessment Volume 1, December 2010* and *Former Station Master's Residence, Heritage Study and Assessment of Relocation Costs for RTA, January 2011* present the background, history, significance, and potential impact on specific heritage items, and provide a relocation assessment. The 2010 report includes a preference for an outcome which retains the heritage buildings if possible.

However these reports do not comment on or compare the relative impact of each through-town alternative on the heritage buildings. The qualitative comparison by RMS in the Options Study Report 2008 appears to be unsupported by any rigorous assessment.

There are limitations on the proposal to relocate the Station Master's Cottage. The report to RMS (January 2011) which provides advice on the proposed cottage relocation was undertaken without site inspection or internal building inspection and takes no account of the building materials used. The estimate provided to relocate the residence appears optimistic. Evans & Peck considers the proposal as documented lacks appropriate detail and is unlikely to be feasible or cost effective.

The Tunnel option will have significant impact on the heritage-listed items at Church St intersection. The impact will come with the extensive temporary works that are associated with construction of a tunnel in this location. The temporary works will include providing for traffic diversions during construction, providing a construction zone for cut and cover or top-down operations near the tunnel portals where the tunnel is shallow, and providing temporary site access for removal of excavated material.

The design for the Howarth Street alternative includes the construction of a bus lane through the rear of both the Station Master's Cottage and the Warner Shops which is likely to have significant heritage impact.

The Widened Carriageway alternative will likely have an impact on both the Station Master's Cottage and the Warner Shops. Retaining these heritage items at the expense of the road corridor is likely to compromise road design standards and potentially the safety of road users and pedestrians. RMS has not adequately demonstrated that road design standards can be satisfied in the proximity of the Station Master's Cottage and the Warner Shops.

The Land Bridge and Split-Level Carriageways alternatives will have significant impact on the heritage-listed items. These alternatives require the removal of both buildings.

Evans & Peck do not agree that any of the alternatives would provide substantially less impact on heritage items, or perform better in relative terms. All of the alternatives as documented are likely to have a negative impact on the heritage-listed items to some extent.

6.3.3 Traffic Capacity

Evans & Peck consider that each through-town alternative, if constructed to accommodate four lanes, will provide improved traffic capacity for through traffic on the Pacific Highway and the surrounding network. The RMS qualitative comparison for this criterion finds that all alternatives will perform equally for through traffic, and Evans & Peck generally agrees with this assessment.

The performance of alternatives varies somewhat when considering travel times and intersection levels of service as noted in the report, *Wyong Town Centre Paramics Modelling June 2008.* This report provides the following conclusions:

- *Modelling shows that, of the three upgrade options, the Tunnel option provides the least benefit in terms of improvements in travel time and intersection Levels of Service.*
- *The Tunnel Option results in significantly less surface capacity on the Pacific Highway through Wyong Town Centre, and restricts a number of turning movements, in particular, the movement of vehicles from the west to the south through the Town Centre. This results in significant queuing on the western approach of Church St at the Pacific Highway. For this reason, the Tunnel Option is not recommended*
- *Modelling of the Existing Alignment Option and the Two Level Road Option showed no significant difference in travel times or intersection Levels of Service. Investigation of alternative phasing in the Existing Alignment Option also showed no significant improvement in travel times or intersection Levels of Service.*
- *Investigation of queues showed significantly less queuing in the Two Level Road Option than in the Existing Alignment Option, particularly in the AM and PM peaks.*
- *The provision of turning movements in the Two Level Road Option that are restricted in the Existing Alignment Option makes the Two Level Road Option the preferred option of the three tested.*

Based on these outcomes from modelling investigations up to 2008, and considering performance of alternatives beyond the criteria of through traffic only, the Widened Carriageway and Split-Level Carriageway perform better than other alternatives on travel time and intersection levels of service, and the Split-Level Carriageway performs best overall on turning movements and queuing. Post 2008, improvements to the Widened Carriageway alternative (Preferred Option) have reversed the advantage of the Split-Level Carriageway.

Notwithstanding the RMS qualitative comparison in Figure 5 against through traffic capacity, the traffic model performance should be considered more widely in the assessment of benefits to identify differences along the corridor and the relative merit of each through-town alternative.

6.3.4 Vehicle and Pedestrian Access

The qualitative comparison presented by RMS fairly represents the relative ease of local street access for each through-town alternative.

Evans & Peck accept that local traffic access to side roads will be restricted with the Tunnel and Howarth Street alternatives and to a lesser extent with the Land Bridge alternative. The Wyong Town Centre Paramics Modelling June 2008 report notes the restriction on turning movements with the Tunnel option, in particular, the movement of vehicles from the west to the south through the Town Centre.

The Widened Carriageway and Split-Level Carriageway alternatives maintain all existing intersections and most of the existing turning movements to side roads thereby offering better local traffic access than the other alternatives.

Each through-town alternative will be designed to maintain adequate pedestrian access connecting the town centre shops and Wyong railway station, and RMS has ranked four of the five alternatives with equal performance. Whilst there is no separate technical study to support this assessment, Evans & Peck expect that all alternatives can address pedestrian connectivity. The Howarth Street alternative may provide less pedestrian convenience with the southbound carriageway being east of the railway station and further from the town centre, and arguably ranks slightly lower than the other alternatives.

Evans & Peck generally agrees with this RMS qualitative comparison against the vehicle access and pedestrian access criteria.

6.3.5 Car Parking

The report*, Business Impact Assessment - December* 2010 gives strong indication that the upgrade project will have an insignificant impact on retail trade as a result of parking space loss. The Widened Carriageway and Split-Level Carriageway may have a similar effect on town parking, but the Split-Level Carriageway is reported to have a substantial impact on rail commuter parking.

Based on the number of parking spaces lost for each alternative as tabulated in Table 14 of the *Options Study Report, July 2008,* the comparative ranking of the alternatives by RMS appears valid assuming equal weighting for parking on the highway and in the rail commuter car park. The Tunnel ranks least impact assuming no parking is lost in the rail commuter car park post-construction. If loss of parking on the highway is considered alone, the Howarth Street and Land Bridge alternatives would rank least impact, and the Widened Carriageway would rank highest impact.

Evans & Peck generally agrees with this RMS qualitative comparison against the car parking criteria, assuming loss of parking is equally weighted regardless of location.

6.3.6 Ease of Construction

All the through-town alternatives have their individual challenges associated with construction. RMS has ranked the alternatives in two broad categories (moderate and significant construction challenges) based on engineering complexity. The key issues associated with construction of each alternative have been listed, with the exception of traffic management and work under traffic which

is identified for the Widened Carriageway only. The Tunnel, Land Bridge and Howarth Street alternatives all involve technically challenging structures and site constraints, and are ranked highest impact. The Widened Carriageway and Split-Level alternatives whilst not so technically difficult are arguably more disruptive to the Wyong town centre and through traffic during construction.

Assuming ranking is based on technical complexity alone, Evans & Peck generally agrees with the RMS qualitative comparison against the ease of construction criteria.

6.3.7 Estimated Cost

The independent estimates by Evans & Peck are compared against RMS estimates in section 4.0 of this report. Whilst those estimates do not all lie within the cost bands presented in Figure 5, Evans & Peck's ranking of the through-town alternatives based on cost is similar to RMS. On this basis Evans & Peck strongly agrees with the RMS qualitative comparison against the estimated cost criteria.

6.4 General Commentary

The Tunnel and Howarth Street alternatives are high cost and, together with the Land Bridge alternative, pose significant construction complexity and do not achieve the road user benefits of the Widened Carriageway or Split-Level Carriageway alternatives.

The Widened Carriageway and Split-Level Carriageway alternatives rank lowest cost and the traffic benefit of each is dependent on the configuration of intersections, allowable turning movements and pedestrian crossing opportunities. The Widened Carriageway ranks lowest impact on retail trade criteria ahead of the Split-Level alternative, and the Widened Carriageway outperforms the Split-Level Carriageway on loss of car parking. Both these alternatives involve moderate construction challenges and issues.

Internal approval to implement any non-conforming road geometry for the RMS Preferred Option adjacent to or near the heritage buildings is recommended before any further analysis of traffic models or cost estimating is progressed. Evans & Peck recommends a Road Safety Audit also be undertaken for the RMS Preferred Option to consider in the context of the heritage buildings, the proximity of traffic lanes, roadside shoulders, drainage-structures, footpaths and shared cycle paths, public utility allocations, property adjustments and public utility adjustments.

7 Road User Benefit

This section responds to the terms of reference requirement to review the Road User Benefit-Cost analysis undertaken to date by RMS. The analysis under review was provided by RMS and is included as Appendix 10 to this report.

In undertaking this review Evans & Peck has referenced the RMS Economic Analysis Manual, Version 2, 1999 and the analysis results provided by RMS dated 5 March 2012.

7.1 Background

The RMS Road User Benefit analysis provided for this review is limited in scope to one of the five through-town alternatives only, and although not stated, Evans & Peck has assumed the analysis is based on the Preferred Widened Carriageway option. The capital cost used in the analysis corresponds to the RMS cost estimate for the Preferred Widened Carriageway dated February 2012. A Project Appraisal Report was not provided by RMS as part of the analysis for this review.

7.2 Basis of Review

This review is based on the Road User Benefit analysis provided by RMS, referencing the results against the RMS requirements and procedures for reporting and presenting findings of an economic appraisal. These requirements are contained in the RMS Economic Analysis Manual, which details the scope for a Project Appraisal Report and specifies the supporting information required and key parameters to be reported. The supporting information and parameters (including Net Present Value, Benefit Cost Ratio, and Internal Rate of Return) were reviewed against the key information requirements.

7.3 Information Required

7.3.1 Description of Problem and Project Objectives

This information is not specifically stated in the results of the analysis provided by RMS, but is assumed by Evans & Peck to be the project objectives as listed in the *Options Study October 2006* as follows:

- To improve the safety of all road users including pedestrians, cyclists and motorists;
- To reduce traffic congestion;
- To provide a high standard direct link between the commercial and industrial precincts of Tuggerah and the residential precincts to the north of Wyong;
- To improve urban amenity in the township of Wyong;
- To allow for improvements to road-based public transport services along the corridor, and
- To provide facilities for pedestrians and cyclists along the corridor.

7.3.2 Description of the Base Case and Project Options

As the base case and definition of options has not been provided for this review, Evans & Peck has assumed:

- The base case is the 'Do Nothing' option; and
- The project options are the Eastern Corridor (East Bypass), Western Corridor (West Bypass) and Central Corridor.

The Central Corridor option using the Widened Carriageway alternative is the focus of the Road User Benefit analysis provided for this review. There are no other Road User Benefit calculations available for review and there is no comparison of road user benefits for the base case and project options.

7.3.3 Evaluation Assumptions

The key input parameters, assumptions and supporting documents (such as Paramics Traffic Modelling, Traffic Report and accident statistics) have not been provided by RMS for this review.

The Economic Analysis Manual includes a series of analysis models for use in Road User Benefit calculations. In the absence of RMS key assumptions, Evans & Peck has assumed the Rural Evaluation System (REVS) has been used.

The Pacific Highway Upgrade through Wyong town centre would be part of a series of projects if the defined project objectives were to be met. The strategic route option corridors extend from Johnson Road in the south to Johns Road, Wadalba in the north. The capital cost used in this road user benefit calculation is the 2011 RMS cost estimate for the Widened Carriageway through-town option for work between Johnson Road and Cutler Drive. This represents 2.1km out of a total corridor length of 5.1km.

The relationship between this project and how the work fits into the overall strategic route options for Wyong is not stated. This project could be defined at a number of levels, from individual jobs or sections, up to links and corridors. The selected level is unclear, and will depend on the analysis objectives and whether the proposed job is part of a series of related expenditures to meet the project objectives. The calculations provided for this review have not been defined to show how the Widened Carriageway through-town alternative from Johnson Road to Cutler Drive relates to the remaining jobs (i.e. the remaining 3km from Cutler Drive to Johns Road) that make up the Central Corridor option.

In the absence of a Project Appraisal Report clearly setting out the assumptions upon which the RMS analysis is based, Evans & Peck is unable to verify the analysis results against the project objectives. The use of data from traffic modelling and accident numbers are evident in the analysis results however without the supporting documents or clarity of traffic arrangements modelled, Evans & Peck are not able to verify the inputs used in the analysis against the results.

7.3.4 Calculated Decision Criteria:

The analysis is presented in accordance with the Economic Analysis Manual using the correct parameters for Cost Benefit Analysis based on estimated project cost, and applying:

- contingency of 25%, 50% and 90%;
- discount rates of 4%, 7% and 10%; and
- growth rates of 0.5% and 1.0% for sensitivity analysis.

The analysis period was 20 years, which is appropriate for this project. The results of the analysis are set out in Table 25 below.

Table 25: Road User Benefit Results

Cost Benefit Analysis Parameter	Results of Analysis
Net Present Value (NPV) The difference between the present value of benefits and the present value of costs.	Range, from $635.54m to $703.11m. All cases examined provide greater road user benefits than costs indicating the project is worthy of consideration for funding.
(NPVI) NPV per $ of capital outlay NPV divided by the present value of the investment costs.	Range within 19.01 to 11.55. For project selection.
Benefit Cost Ratio (BCR)	Range within 6.7 to 20.0 indicating investment should be considered.
Incremental BCR	Not applicable for this analysis.
IRR (for financial evaluation)	Not presented.
First Year Rate of Return	Ranges within 25.5% to 49.9%, all are above 7% indicating the project should be considered for investment.

7.3.5 Results of Sensitivity Analysis

A sensitivity analysis has been included in accordance with the manual guidelines using a range of decision criteria for contingency, discount rate and growth as described above.

7.3.6 Project Summary

A project summary was not provided with the analysis, however a description of the Preferred Widened Carriageway alternative is well documented in the various support documents.

7.3.7 Traffic Data

Traffic data on which this analysis is based has not been provided or confirmed by RMS for this review. Some information including cost input metrics, accident crash savings and a spreadsheet containing undefined traffic numbers was provided with the analysis however Evans & Peck was unable to interpret the data and verify the results without the supporting documentation.

7.3.8 Time Streams of Costs and Benefits

This information was not provided with the analysis.

7.3.9 Capital and Maintenance Costs

As stated, the capital cost used in the analysis appears to be based on the RMS cost estimate for the Widened Carriageway (dated February 2012). With only limited cost data provided, Evans & Peck is unable to verify whether maintenances costs have been included in the analysis.

7.3.10 Travel Time, Vehicle Operating and Accident Cost

Travel Time Savings, Vehicle Operating Costs and Accident Costs under the heading of Safety are included in the analysis however, without the traffic data and modelling, the benefits and costs cannot be verified. There is reference to a parameter, 'Value of an average crash', however without the context and other supporting data, the significance of this parameter in the analysis cannot be verified.

7.3.11 Other Benefits and Dis-Benefits

Based on the data provided, there is no evidence of other benefits or costs included in the analysis.

7.3.12 Discounting Calculations

Discount rates of 4%, 7% and 9% are used in the analysis consistent with manual requirements.

7.3.13 Intangible Effects

This information was not provided with the analysis.

7.3.14 Economic Appraisal Checklist

This information was not provided with the analysis.

7.3.15 Summary

Evans & Peck has reviewed the Road User Benefit analysis against the requirements in the RMS Economic Analysis Manual and make the following observations:

- The analysis appears to comply with RMS guidelines in the Economic Analysis manual, however the process for economic evaluation has not been applied in its entirety;
- The data and information to support the analysis is incomplete;
- The key assumptions are not defined;
- The analysis is limited to the RMS preferred option, with no comparison against other project options or alternatives; and
- The BCR, NPV, NPVI and FYRR parameters calculated appear favourable for investment to be considered.

7.4 Recommendation

To improve the accuracy and value of the Road User Benefit analysis, Evans & Peck offer the following recommendations:

- Clearly define the project limits for all options consistent with the objectives listed in the *Options Study October 2006,* or alternatively update the project objectives in accordance with revised constraints;
- Ensure the project and alternative options are feasible and set clearly against the project objectives;

- For the purpose of the Road User Benefit analysis clarify whether a through town alternative such as the Widened Carriageway option, is a stand-alone project or part of a series of jobs in a link or corridor;
- Update the traffic models and traffic report to align with the preferred scope of feasible options and thereby improve the reliability of the Road User Benefit analysis;
- Reassess the Road User Benefits and report the analysis in the form of a completed Project Appraisal Report, in accordance with the Economic Analysis Manual requirements.