

9 Project Cost

9.1 Scope Definition

The Ross Lane to Ewingsdale section of the Pacific Highway upgrade as originally envisaged was a 15.8 km length of dual carriageway between the northern end of the Ballina Bypass at Ross Lane and southern extent of the existing dual carriageway at Ewingsdale.

Following the decision to expand the study area in April 2005, the project limits were extended to Sandy Flat Road. These adjusted limits were used to determine the comparative costs for each of the short listed options as detailed in **Chapter 3**.

Given that the route selection process has identified a preferred route which incorporates the northern end of the Ballina Bypass, it has been agreed with the RTA that the section of the Ballina Bypass between Sandy Flat and Ross Lane should remain as part of the Ballina Bypass. Therefore the project limits for the preferred route revert to the original limits between Ross Lane and Ewingsdale.

The preliminary cost estimates for the preferred route have therefore been prepared based on a preferred route which extends from Ross Lane to Ewingsdale, a length of 18.9 km on the existing highway or 17.0 km along the preferred route. The preliminary cost estimate has been prepared in accordance with the RTA's *Project Estimating Manual* (RTA Project Management Office, December 2001).

The scope of works for Tintenbar to Ewingsdale preferred route is as follows:

- Project extends from Ross Lane in the south to Ewingsdale interchange in the north.
- Class M standard, 110 km/h posted speed limit, controlled access with no at-grade intersections.
- Two lanes in each direction with a 12 m wide median which allows for the addition of a third lane in each direction.
- Carriageway width of 11.5 m at bridges and tunnel to allow addition of third lane in each direction without widening of structures. This width assumes that when the third lane is added, cyclists would be diverted onto the existing highway as an alternative route.
- Diversion or grade separation where local roads cross the proposed highway. Bridges to carry existing local roads above the upgraded highway are proposed at the following locations:
 - Ivy Lane (single 6 m wide structure about 70 m long).
 - Existing highway south of Newrybar (single 11 m wide structure about 155 m long).
 - Broken Head Road (single 11 m wide structure about 125 m long).
 - Private property access north of Skinners Creek (single 6 m wide structure about 50 m long).

Underpasses allowing local roads to pass underneath the upgraded highway are proposed at the following locations:

- 500 m south of Martins Lane West
- Watsons Lane
- Tinderbox Road
- Separation of local and through traffic by provision of a separate road for local traffic, generally the existing highway.
- No intermediate interchanges between the proposed Ross Lane interchange and the existing interchange at Ewingsdale. It is assumed that the Ross Lane interchange and south facing ramps are to be constructed as part of the Ballina Bypass. The proposal includes allowance for the

addition of north facing ramps at the Ross Lane interchange and minor modifications to the Ewingsdale interchange to allow separation of local and through traffic to the south.

- A tunnel through St Helena Hill, approximately 250 m long.
- There are six main bridges on the preferred route as follows
 - Bridge across Sandy Flat Creek (twin structures about 10 m long).
 - Bridge across unnamed creek about 300 m south of Emigrant Creek (twin structures about 90 m long).
 - Bridge across Emigrant Creek (twin structures about 120 m long).
 - Bridge across Skinners Creek (twin structures about 120 m long).
 - Bridge across Bangalow Road (twin structures about 30 m long).
 - Bridge across Byron Creek and Railway (twin structures each about 175 m long).
- Upgraded highway designed for B-Double usage but not local road connections because none of the local roads are designated for B-Double usage.
- Cross drainage designed to accommodate 1 in 100 year rainfall event.

9.2 Assumptions

The following assumptions have been made in developing the cost estimate for the preferred route:

- Bridge structures are a standard type with no allowances for long spans, landmark structures or special architectural statements.
- The project can proceed as a single large contract with no delays due to land acquisition.
- Earthworks would be adjusted during detail design to achieve an approximate earthworks balance.
- No allowance has been made for the inclusion of rest areas for heavy or light vehicles to replace the existing southbound rest area located just north of Bangalow.

9.3 Structure of Preliminary Cost Estimate

The cost estimate has been prepared in the standard RTA format which divides the project into six major cost components as follows:

- Project development (includes costs up to and including planning approval).
- Investigation and design (includes design and documentation of the approved project for construction).
- Property acquisition.
- Public utility adjustments.
- Construction (main elements are earthworks, pavements, structures and drainage. Separate allowances are made for environmental works, site management, RTA representation etc).
- Handover (includes costs associated with project completion and handover of completed assets to the relevant authority).

9.4 Risk and Contingency Allowances

Allowances for risk and contingency are included in accordance with the principles described in the *RTA Project Estimating Manual* and following consideration of the issues raised in the project risk management procedures.

At this stage a probabilistic assessment of project risks has not been carried out and contingency allowances are based on an item by item assessment of the various items making up the estimate. Allowances on individual items as well as the resulting global allowances have been reviewed by comparison with typical allowances adopted on other RTA projects with similar levels of engineering and environmental investigations and similar levels of design development.

9.5 Project Programme

After all project approvals are obtained, it is estimated that a period of about two years would be required for land acquisition concurrent with adjustments being made to public utilities, completion of detail design and investigations, and tendering procedures prior to commencement of construction.

On the assumption that construction would be carried out as one large contract, it is anticipated that the required construction period would be approximately three years.

Project completion would therefore take at least five years, at a minimum, following project approval.

9.6 Construction Methods

9.6.1 General

The construction estimate is based on application of standard construction methodology. Actual construction methods could vary depending on the chosen procurement method, the contractor and the conditions of approval by the NSW Minister for Planning, but would include the following activities for each section of the proposed works:

- Acquisition of land.
- Adjustment of existing public utilities.
- Pre-clearing investigations to confirm locations of flora and fauna of conservation significance.
- Site establishment including survey set out, safety fencing of site, and establishment of site compounds, and access points and access routes.
- Installation of traffic management measures to control highway and construction traffic during construction.
- Installation of temporary erosion, sediment and water quality controls including diversion drainage, sedimentation basins and cross-flow culverts.
- Establishment of stockpile areas.
- Clearing of vegetation and mulching of plant material for reuse.
- Stripping, stockpiling and management of topsoil.
- Treatment of any soft soil areas under embankments.
- Earthworks.
- Installation of drainage lines, fauna underpasses and local access.
- Establishment of asphalt and concrete batch plants.
- Bridge and tunnel construction.
- Subgrade preparation and pavement construction.

- Topsoil rehabilitation and revegetation of batters and berms.
- Landscaping.
- Installation of noise mitigation measures (note that, where possible, noise mitigation measures would be installed earlier in the construction process where not dependent on completion of earthworks and where they would be of benefit in reducing construction noise).
- Line marking and signposting.
- Interchange lighting.
- Completion works (including general site clean up and removal of site compounds).

9.6.2 Earthworks

It has been assumed that a haul road would be established along the route corridor to allow efficient and safe haulage of material using bulk handling equipment.

The preliminary geotechnical investigations have identified that there are five cuttings where blasting is likely to be required. The investigations also indicate that excavated material would be suitable for general fill and with crushing would also provide material suitable for pavements and select fill.

Considering the scale of the project, the volume of earthworks and the type of material expected, establishment of site crushing and batching plants is likely to be cost effective and has been assumed.

9.6.3 Pavements

Concrete pavement has been assumed for the purposes of the cost estimate. Allowance is included for the addition of a layer of low noise road surfacing in areas with a concentration of dwellings.

Soft soils are not a significant issue for the shortened section from Ross Lane to Ewingsdale and plain concrete pavement has been assumed, comprising a 250 mm concrete base over a 150 mm concrete sub-base.

Considering the scale of the project and the type of material expected, establishment of site crushing and batching plants is likely to be cost effective and has been assumed.

9.6.4 Bridges

There are no major bridges across large waterways and it is anticipated that all bridge structures would be standard structures without long spans or any special architectural statements.

Most of the larger bridges could be constructed free of traffic, the exceptions being the existing highway bridge above the upgraded highway just south of Newrybar and the bridge carrying Broken Head Road above the upgraded highway near Newrybar which could both be constructed using top-down techniques. Construction of the bridge across Bangalow Road would require construction above an operating roadway.

9.6.5 Tunnel

Preliminary geotechnical investigations indicate that the tunnel would be through the Lismore Basalt which generally comprises relatively competent high strength basalt separated by more weathered and fractured basalt layers.

Tunnel construction would adopt techniques used previously in NSW. Twin tunnels with an arched roof profile and a rock pillar separating the tunnels are expected to be suitable considering the ground conditions, similar in profile to the recently constructed Cudgen Road Tunnel. Tunnel excavation would use conventional drill and blast techniques.

The tunnel is not expected to significantly affect the existing groundwater regime and a drained tunnel (unlined) is proposed. Rock bolts and shotcrete would be utilised to provide the primary and permanent tunnel support along with pre-grouting to reduce the permeability of the rock and strengthen the rock mass.

9.7 Preliminary Cost Estimate for Preferred Route

The preferred route is made up route sections A/B, A1-a, B1-b, B1-c, A2 and T2. A number of minor adjustments and refinements have been made in combining the sections, particularly at the nodes where the sections join.

The preliminary cost estimates are based on detailed quantities derived from the 3D model of the collated sections making up the preferred route. All access roads have also been modelled in 3D to confirm the feasibility and extent of providing required local access.

The preliminary cost estimate has been prepared in accordance with the RTA *Project Management Guidelines for Estimating, Scope and Cost Control for Development Projects* (Version 3, RTA 2000). The estimates are based on typical construction contract rates and on quantities derived from the preliminary concept design of the preferred route.

The construction cost estimate has been developed by applying unit rates to the derived quantities. The unit rates are based on historical data, with care taken to ensure that the adopted rates reflect similar work items and are corrected as required for inflation and site conditions. Rates are inclusive of contractor overheads and profit.

The estimate has been prepared using the current concept design; it will undergo value engineering and further refinement in the project approval process.

The estimated total project cost for the preferred route is \$368 million at March 2006 costs. The estimate is summarised in **Table 9.1**.

Table 9.1 Preliminary Cost Estimate for Preferred Route*

Item	Base Estimate (excluding contingency) (\$M)	Contingency		Final Estimate (including contingency) (\$M)	% of Total
		%	Amount (\$M)		
Project Development	13.2	35.2%	4.7	17.9	4.9%
Investigation and Design	7.6	35.0%	2.7	10.3	2.8%
Property Acquisitions	24.7	94.3%	23.3	48.0	13.1%
Public Utility Adjustments	7.5	70.0%	5.2	12.7	3.5%
Construction	210.2	29.5%	61.9	272.1	74.0%
Handover	4.8	35.0%	1.7	6.5	1.8%
TOTAL	268.0	37.1%	99.5	367.5	100.0%

* Costs exclude the Ballina Bypass section.

The preliminary cost estimate of \$368 million for the preferred route is slightly less than the comparative cost estimate of \$385 million presented in **Table 3.16** (and **Appendix C**) for Option 25 which became the preferred route. The difference is a result of adjustments which have been made in preparing the preferred route estimate as follows:

- As noted in **Section 9.1**, the preferred route estimate is for the length between Ross Lane and Ewingsdale and excludes the section of the Ballina Bypass between Sandy Flat and Ross Lane.

- In combining sections A/B, A1-a, B1-b, B1-c, A2 and T2, a number of minor design adjustments and refinements have been made, particularly where the sections connect to each other. Generally these adjustments and refinements have slightly reduced the estimated cost.
- Contingency allowances have been increased from 30% to 37% overall, in line with RTA policy.

9.8 Reality Check of Preliminary Cost Estimate

Reality checks for the estimates are provided in **Table 9.2**.

Table 9.2 Reality Check for Preliminary Cost Estimate

Project Cost / km	\$21.6 M
Project Cost / lane-km	\$5.4 M
Earthworks Cost / m ³	\$18
Pavement cost / m ²	\$159
Structure cost / m ² deck area	\$3,280

Project costs are high on the per km and per lane km measures compared to other RTA projects but reflect the cost of the tunnel (excluding the tunnel the project cost/km is about \$18.2 M.) Other costs appear reasonable given that the rates include contingency allowances.

9.9 Economic Analysis

An economic analysis for the preferred route between Ross Lane and Ewingsdale has been completed using the RTA's Rural Evaluation System (REVS) road user cost benefits analysis model.

The results of this analysis indicate the preferred route is economically justified with the following results:

- Benefit Cost Ratio (BCR) of about 1.6.
- Internal rate of Return (IRR) of about 10%.