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ALBURY WODONGA POTENTIAL NATIONAL HIGHWAY ROUTES

VOLUME 1B
MAIN REPORT

ENVIRONMENTAL IMPACT STATEMENT / ENVIRONMENT EFFECTS STATEMENT

OCTOBER 1995

GHD

Victoria ON THE MOVE

DEPARTMENT OF Transport

ROADS AND TRAFFIC AUTHORITY OF NSW/VICROADS

ALBURY WODONGA
POTENTIAL NATIONAL HIGHWAY ROUTES

VOLUME 1B -- MAIN REPORT

ENVIRONMENTAL IMPACT STATEMENT/
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October 1995

ISBN No: 1-875831-00-2
RTA Catalogue No: CRB 95.037

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211/027439/00
R4392/ME:NL

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20 CURRENT ECOLOGICAL ISSUES

20.1 Ecological Concepts

Many of the ideas associated with current ecological issues originated from the 1980 World Conservation Strategy which formed the basis of national conservation strategies adopted by Australia in 1984.

These have since been expanded by the Commonwealth Government to establish a number of principles as follows (Commonwealth Government, 1990):

- integrating environmental and economic goals in policies and activities;
- ensuring that environmental assets are appropriately valued;
- providing for equity within and between generations;
- dealing cautiously with risk and irreversibility;
- recognising the global dimension.

In each of these principles, sustainable development is human centred. It is primarily concerned with the maintenance of human welfare by meeting human needs and ensuring the quality of human life.

This concept was further advanced at the 1992 Rio Declaration on Environment and Development which included a declaration that

> *'Human beings are at the centre of concerns for sustainable development. They are entitled to a healthy and productive life in harmony with nature'. (UNCED 1992).*

Legal definition to the concept of sustainable development is provided by the Protection of the Environment Administration Act 1991 (NSW) which established the NSW Environment Protection Authority. Section 6(1)(a) of the Act requires the Authority to

> *'have regard to the need to maintain ecologically sustainable development .... through ..... the effective integration of economic and environmental considerations in decision making processes'.*

Core principles aimed at assisting in the achievement of ecologically sustainable development are set out in the Intergovernmental Agreement on the Environment and are incorporated into the environmental impact assessment process by Schedule 2 of the NSW Environmental Planning and Assessment Regulation 1994 as follows:

- The *precautionary principle* – namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be issued as a reason for postponing measures to prevent environmental degradation.

- *Inter-generational equity* – namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations.

- Conservation of *biological diversity and ecological integrity* – namely, that measures which halt the non-evolutionary loss of species and genetic diversity should be pursued.

- *Improved valuation and pricing of environmental resources* – namely, that while prices for natural resources should be set to recover the full social and environmental costs for their use and extraction, many environmental values cannot be priced in monetary terms.

Current ecological issues which have been considered in light of this proposal and are discussed below include:

- climate change and greenhouse effect;
- ecologically sustainable development;
- precautionary principle;
- inter-generational equity;
- biological diversity and ecological integrity;
- valuation and pricing of environmental resources.

Further issues, including land degradation (salinity, groundwater etc), resources, soil contamination and the like are discussed elsewhere in Section D of the EIS/EES.

20.2 Climate Change and Greenhouse Effect

Australia, on a per capita basis, was ranked second in a 1988 listing of greenhouse-gas contributors. Energy efficiency measures involving reductions in energy consumption are supported by the Federal Government and the NSW and Victorian Governments as a measure which will assist in the overall reduction of greenhouse gases.

The improved road conditions that would result from implementation of the proposal would result in a net reduction in local vehicle emissions. This would be achieved through:

- improved local traffic flow in Albury Wodonga;

- a better environment for pedestrians and cyclists in Albury Wodonga;

- shortened travel times and the associated reduction in fuel consumption;

- increased fuel efficiency for road users through a reduction in the need for deceleration and acceleration;

- improved road capacity which reduces congestion during incidents such as accidents or during peak demand.

20.3 Ecologically Sustainable Development

The issue of sustainable development accommodates economic growth, business interests and the free market as well as the central idea of environmental protection.

The Commonwealth Government in its document *'Ecologically Sustainable Development : A Commonwealth Discussion Paper' 1990* defined ecologically sustainable development as:

> *'using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained and the total quality of life, now and in the future can be increased'.*

Generally, ecologically sustainable development aims to address the wise use or reuse of resources.

The National Strategy for Ecologically Sustainable Development (Commonwealth of Australia 1992) sets out several objectives to achieve a more sustainable use of energy and natural resources in the transport sector. These are:

> *'Objective 6.1 – to promote urban forms which minimise transport requirements, and improve the efficiency of land supply and infrastructure provision.*
>
> *Objective 6.2 – to encourage the future development of urban transport systems which provide opportunities to limit the use of fossil fuels.*
>
> *Objective 8.4 – to improve the technical and economic efficiency of urban and non-urban transport; encourage switching to alternative transport technologies or modes where this reduces greenhouse gas emissions per passenger or unit of freight; and to optimise the modal mix of transport to achieve greater economic, environmental and social benefits.'*

Design of the proposed National Highway route would be consistent with these objectives. Factors that would assist this include:

- those factors listed in Section 20.2 as reducing greenhouse gas emissions;
- the provision of a new National Highway route that would create the potential for better urban use of the old (existing) highway route, including better use of existing infrastructure and in-fill development.

The design adopted would maximise the opportunities for emission reduction and minimise the potential for increases in emissions.

Ecologically sustainable development is about efficient use of resources. The design of the new National Highway route would aim to balance cut and fill earthworks to both minimise the overall environmental impact and the need for imported fill material or the disposal of material outside the study area. As well, the new route would be designed, constructed and maintained in a manner that maximises the life expectancy of the pavement and associated infrastructure.

The life expectancy of the pavement, based on current construction methods and building materials, is 40 years. However with an ongoing maintenance strategy, the life expectancy of the highway and materials used in its construction can be considerably extended.

Design criteria used for the new route would aim to cater for long-term use demands with the aim of providing a more user friendly and safe travel environment for existing and future road users.

20.3.1 Biological Diversity and Ecological Integrity

Conserving biological diversity generally means that a full and diverse range of plant and animal species should be maintained.

As a signatory to Agenda 21, of the Rio Earth Summit Initiative, the Australian Government has responsibilities including the conservation of biological diversity or biodiversity with the aim of protecting native species.

The results of flora and fauna surveys of both the inner and outer route show that the potential presence of rare and endangered species along the proposed routes are significantly reduced because there has already been substantial clearing for grazing and agricultural activities resulting in the simplification of flora and fauna species represented in the study area.

With the exception of the bush stone curlew, flora and fauna species recorded are generally common or not considered endangered in NSW, Victoria or Australia. In order to address the habitat needs of these species, environmental safeguards would be included such as the re-establishment of native vegetation species along the proposed route corridor. These areas would, in time, provide habitat for fauna species and impacts associated with this project are not significant.

Revegetated areas would also provide wildlife movement corridors.

20.3.2 Inter-generational Equity

Inter-generational equity has been defined by Weiss (1990) as a concept which says that humans *'hold the natural and cultural environment of the Earth in common both with other members of the present generation and with other generations, past and future'.* In other words the present generation has inherited the Earth from its forebears and should ensure the diversity and productivity of the environment is maintained or enhanced and passed on in a condition which has a positive benefit for future generations. The most significant aspect of this concept is that future generations should not inherit a degraded environment.

The design of the new route, coupled with environmental safeguards and monitoring detailed in this EIS/EES would ensure that the environment would not be degraded for existing or future generations. The proposal minimises the extent of cut and fill required and does not impact significantly on the local fauna populations or native flora. It has significant benefits for the existing population as it improves local traffic conditions and provides a safe and consistent travelling environment for long distance travellers.

Relics or items of archaeological significance have been recorded or protected (depending on the significance of the item) for the benefit of existing and future generations.

In general the proposal has been designed, and would be constructed and operate in a manner which would benefit both existing and future generations.

20.3.3 Precautionary Principle

The Intergovernmental Agreement on the Environment (IGAE) prepared in 1992 between Commonwealth, State, Territory and Local Government, provides a definition for the precautionary principle as follows:

> *'Where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.*
>
> *In the application of the precautionary principle, public and private decisions should be guided by:*
>
> *(i) careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment; and*
>
> *(ii) an assessment of the risk-weighted consequences of various options.'*

The IGAE states that the precautionary principle is to be a guiding principle for informed 'policy making and programme implementation' by all levels of government in Australia. In this manner, it is to guide both the public and private sector in its decision making and assessment of different options, particularly when decisions are being made in the face of uncertainty. In doing so, it requires avoidance of serious or irreversible damage to the environment whenever practicable.

This project has followed the precautionary principle by ensuring that the environmental risks associated with the project have been considered from the outset and environmental management practices and safeguards would be implemented as part of the Environmental Management Plan, discussed in Section 32.2.

The precautions and safeguards recommended with regard to impacts are adequate to reduce the uncertainties surrounding the possible long-term impacts of the development. The proponents are committed to the development of an Environmental Management Plan to ensure that the outcomes of the environmental impact assessment process are met during the construction process.

20.3.4 Valuation and Pricing of Environmental Resources

The IGAE and the Protection of the Environment Administration Act both call for improved valuation, pricing and incentive mechanisms which should inform policy making and program implementation. In other words, environmental factors should be included in the valuation of assets and services.

The integration of environmental and economic goals is one of the key principles of sustainable development set out by the Commonwealth Government and is a feature of the Intergovernmental Agreement on the Environment.

Cost-benefit analysis can be applied to assist in deciding which way to proceed towards sustainable development. It is a means of helping decisions to be made in an objective and rational manner by allowing the costs of proceeding with a project to be measured against the benefits arising from the project in like and numeric terms.

The EIS/EES has incorporated the benefits and costs of the operational road environment into its cost benefit evaluation. Matters such as travel time, operating costs and safety have all been built into the equation.

The IGAE also commits the States to the polluter pays principle. The safeguards and monitoring aspects of the proposal set out in this EIS/EES ensure that any potential pollution arising as a result of the proposal is addressed and included in the Environmental Management Plan.

20.4 Environmental Issues -- Administration

20.4.1 Intergovernmental Agreement on the Environment

The IGAE defines the responsibilities and interests of each tier of government in relation to environmental issues. The responsibilities and interests of the NSW and Victorian State Governments as identified in the IGAE include:

> *"2.3.1* *Each State will continue to have responsibility for the development and implementation of policy in relation to environmental matters which have no significant effects on matters which are the responsibility of the Commonwealth or any other State.*
>
> *2.3.2* *Each State has responsibility for the policy, legislative and administrative framework within*

which living and non living resources are managed within the State.

2.3.3 *The States have an interest in the development of Australia's position in relation to any proposed international agreements (either bilateral or multilateral) of environmental significance which may impact on the discharge of their responsibilities.*

2.3.4 *The States have an interest and responsibility to participate in the development of national environmental policies and standards."*

In defining administrative responsibilities for each tier of government the IGAE identifies links between governments and a range of actions to be undertaken should an environmental matter be of significance to more than one tier of government. The actions to be taken between the State and the Commonwealth as identified in the IGAE are as follows:

"2.5.1.1 *Where there is a Commonwealth interest in an environmental matter which involves one or more States, that interest will be accommodated as follows:*

(i) *the Commonwealth and the affected States will cooperatively set outcomes or standards and periodically review progress in meeting those standards or achieving those outcomes; or*

(ii) *where outcomes or standards are impractical or inappropriate, the Commonwealth may approve or accredit a State's practices, procedures, and processes; or*

(iii) *where the Commonwealth does not agree that State practices, procedures or processes are appropriate, the Commonwealth and the States concerned will endeavour to agree to modification of those practices, procedures and processes to meet the needs of both the Commonwealth and States concerned;*

(iv) *where agreement is reached between the Commonwealth and a State under (iii) the Commonwealth will approve or accredit that State practice, procedure or process".*

2.5.1.2 *Where it has approved or accredited practices, procedures or processes under 2.5.1.1 the Commonwealth will give full faith and credit to the results of such practices, procedures or processes when exercising Commonwealth responsibilities.*

2.5.1.3 *Where a State considers that its interests can be accommodated by approving or accrediting Commonwealth practices, procedures or processes, or an agreed modified form of those practices, procedures or processes, a State may enter into arrangements with the Commonwealth for that purpose.*

2.5.1.4 *Where a State has approved or accredited practices, procedures or processes under 2.5.1.3 that State will give full faith and credit to the results of such practices, procedures or processes when exercising State responsibilities.*

2.5.1.5 *The Commonwealth and the States note that decisions on major environmental issues taken at one level of government may have significant financial implications for other levels of government and agree that consideration will be given to these implications where they are major or outside the normal discharge of legislative or administrative responsibilities of the level of government concerned.*

2.5.1.6 *Clause 2.5.1.5 applies to each of the Schedules to this Agreement".*

20.4.2 Government Agency Response

In recognition of the IGAE, this EIS/EES has been prepared through a process which meets the requirements of the Federal Government and the NSW and Victoria Governments. The relevant agencies for each government are the Commonwealth Department of Transport and Communications, the EPA (Commonwealth), the RTA (NSW), the DoP (NSW), VicRoads (Victoria) and the Department of Planning and Development (Victoria).

The EPA (Commonwealth) works with all levels of government, business and the community, developing national solutions to Australia's environmental problems. The EPA (Commonwealth) would interact with the National Environment Protection Authority and the Australian and New Zealand Environment and Conservation Council to provide a uniform and coordinated approach to protecting Australia's environment. The EPA administers or is involved with a broad range of issues which are concerned with environmental management, including environmental impact assessment.

The NSW Department of Urban and Regional Planning (formerly Department of Planning) has, in addition to its statutory requirements for EISs, provided detailed 'Advice on the Preparation of an Environment Impact Statement for a Major Road Development in a Rural/Urban Environment', and specific comments on its requirements for this EIS (see Appendix A).

20.4.3 Proponent's Response

The NSW proponent, the RTA, is committed to the preparation and implementation of an Environmental Management Plan. An outline for the EMP is provided in Section 32.2, while a draft table of contents for the plan can be found in Appendix L.

The RTA's Environmental Vision outlines strategies and actions which are incorporated into the range of responsibilities of the RTA. The stated vision is 'a roads and traffic system in harmony with the natural and social environment while meeting community mobility needs'. The RTA is committed to working both independently and with the public, industry and other authorities to implement solutions and recognises the importance of addressing key environmental concerns. Their aim is to protect and enhance the environment by seeking out a comprehensive range of traditional and innovative methods which represent responsible public expenditure, and incorporate these methods into daily work practices at all levels.

To achieve the environmental vision, the RTA states that it will pursue five environmental strategies as follows:

- Reduce the environmental impacts of the roads and traffic system.
- Incorporate environmental considerations into all RTA activities.
- Communications and coordinate with the public industry, and other authorities on environmental impacts and issues.
- Increase environmental awareness within the RTA.
- Conduct and support environmental research.

For each of the five environmental strategies, short-term and long-term actions have been identified on the issues of vehicles, roads, design and planning, construction, maintenance and other matters such as energy efficiency, fuel types used, chemicals and use of chloroflurocarbons.

In Victoria, a Statewide planning policy has been incorporated into all planning schemes for the planning and development of highways and adjacent areas. Of relevance to the environment, the policy recognises that, *inter alia*:

- New highways must be located and designed to minimise detriment to the environment and disruption of residential communities and their amenity.

The major environmental factors influencing the policy are:

- the need to recognise that the relationship between highways and landuse is important to the efficiency of highways, the best use of land, and satisfactory environmental standards;
- the need to ensure the greatest practicable efficiency in the movement of vehicles;
- the need to minimise the adverse effects of highways on the urban environment and the amenity of areas through which they pass, and to exclude highways in locations where they would cause disproportionate detriment.

Under the policy, special attention must be given to the following matters that are relevant to the environment:

- assessment of the location of proposed highways to achieve the greatest overall benefit to the community and with due regard to the environment and ecology;

- the location, planning, design and construction of new highways in a manner which provides for appropriate standards of safety, efficiency and speed, and environmental protection.

VicRoad's environmental policy is contained in its 'Roads and the Environment' draft policy statement of June 1990. Section 3 deals with environmental impact assessment of new roads. It states that VicRoads should:

- undertake environmental studies and community consultation when planning major road and traffic management projects which could have significant adverse environmental effects. Such studies could include mobility, traffic noise, social impact, air quality, landscape quality, flora and fauna, heritage and archaeological studies. EIA will be an integral part of project planning and will involve development and assessment of alternatives. Use will be made of the 'Guidelines for Environmental Impact Assessment and the Environment Effects Act 1978', published by the Department of Planning and Development;

- as part of the planning process evaluate the potential environmental effects of other works and activities and incorporate techniques to enhance environmental quality and minimise adverse effects where possible.

The Victorian proponent, VicRoads, has indicated that they would prepare a joint EMP with the NSW RTA and implement it over the life of the project. The EMP is discussed in Section 32.2.

At the local level, the EIS/EES addresses the provisions of all local environmental planning instruments, as outlined in Chapter 16.

20.5 Conclusion

During the construction and operation of the project, ESD principles would be achieved through the following:

- The improved road conditions would lead to an overall reduction in local vehicle emissions, reducing the Greenhouse Effect.

- The near balancing of cut and fill material should reduce the impact on the environment and contribute to ecologically sustainable development.

- The design, construction and maintenance of the road would be undertaken in such a way as to maximise the life of the pavement and associated infrastructure in an ecologically sustainable manner.

- The design and implementation of the project would ensure that environmental safeguards and monitoring recommended in the EIS/EES prevents degradation of the environment in line with the concept of intergenerational equity.

- The project has taken on board the precautionary principle by ensuring that the environmental risks associated with the project have been considered from the outset and environmental management practices and safeguards would be implemented.

- The project offers substantial energy savings in line with ecologically sustainable development principles.

- The EIS/EES has incorporated the benefits and costs of the operational road environment into its cost benefit evaluation, as part of a valuation and pricing of environmental resources.

- Landscape improvements including the planting and replacing of native species would preserve biological diversity, contribute to the minimisation of climate change and provide a valuable source of habitat for nearby fauna.

The project meets ESD principles as outlined at the State and Federal level, in particular where it is mentioned in the NSW Environmental Planning and Assessment Regulation 1994.

Therefore, the project outlined in this EIS/EES meets core principles aimed at assisting in the achievement of sustainable development practices and the related legislation.

Chapter 21
Energy Conservation

Under Clause 82(2)(n) of the NSW Environmental Planning and Assessment Regulation, 1994, the issue of resource depletion needs to be addressed. Chapter 21 provides a statement on energy conservation, and focuses on construction energy, energy savings and a comparison between the two route options.

DOCUMENT LAYOUT

CHAPTER 21

ENERGY CONSERVATION

21.1 Construction Energy
21.2 Energy Conservation
21.3 Conclusion

21 ENERGY CONSERVATION

The outer route is predominantly greenfields construction and provides a bypass of Albury Wodonga. The total length of this route is 46.69 km between Sweetwater Road and Barnawartha North, and approximately 6.7 million m³ of earthworks are involved.

The inner route shares a common link with the outer route for approximately 10 km between Mullengandra and Bells Road. It then generally follows the alignment of the existing Hume Highway corridor. This route provides an alternative means of access for traffic on the Hume Highway to directly access the business centre of Albury, without first passing through the suburban road network. A second crossing of the Murray River would provide a direct link with the Wodonga Bypass and connect with the existing Hume Freeway.

The total length of new construction for the inner route is 39.63 km with an additional 12 km of existing Hume Freeway required to reach a common point with the Outer Route near Barnawartha North. Approximately 4.3 million m³ of earthworks are involved in the construction of the inner route.

A summary of the route characteristics is shown in Table 21.1.

Table 21.1 -- Route Characteristics

Characteristic	Outer Route	Inner Route	Existing Route
Length of Route (Travel Distance)	46.69 km (Mullengandra to Barnawartha)	51.63 km (Mullengandra to Barnawartha)	55.13 km (Mullengandra to Barnawartha)
Length of Construction	47 km (Mullengandra to Barnawartha)	40 km (Mullengandra to Hume Freeway)	N/A
Earthworks	7.3 million m³	5.3 million m³	N/A

21.1 Construction Energy

The range of construction equipment commonly available for large scale road projects of this type would be used. As is common practice, the work would be undertaken by contract and the mix of construction plant would be proposed by the contractor and may vary in accordance with the type of work required for the section being constructed. Construction would involve extensive use of heavy plant and vehicles such as:

- graders
- bull dozers
- scrapers
- front end loaders
- compacters
- vibrating rollers and compacters
- water trucks
- compressors
- backhoes
- paving machines
- pile drivers
- cranes

- dump trucks
- other heavy weight vehicles
- blasting equipment
- hydraulic rock breaker

It is also likely, depending upon the contractor's material sourcing arrangements, that a temporary concrete batching plant and pug mill would be used in conjunction with this project.

The construction phase of the project would include site preparation, fencing, construction of drainage culverts and pavement surface drainage as well as sedimentation basins, construction of bridges, earthworks, pavement, landscaping, pavement marking, provision of signage and lighting at interchanges.

Vehicles and equipment involved during the construction phase would consume a large amount of fuel. The degree of fuel consumption during the construction phase would be affected by the age of the construction fleet, the type of equipment used, the speed of operation and the ground conditions encountered. Additional energy inputs which are not quantifiable would include raw and manufactured materials, such as the manufacturing concrete/asphalt plant, fabrication of pre-cast structures such as bridgeworks and culverts, steel manufacturing, and the use of equipment, chemicals and human resources.

The inner route requires approximately 7 km less linear construction than the outer route, and requires significantly less earthworks per kilometre. Construction of structures and other features is approximately equivalent. Therefore the energy used in construction would be substantially less.

Based on similar projects, the total fuel consumption during construction could be expected to be as follows:

- Inner Route: 32 million litres
- Outer Route: 47 million litres

21.2 Energy Conservation

The type of road surface can significantly affect fuel economy, with trucks consuming less fuel on concrete pavements than asphalt pavements. Both routes would provide a bypass of Albury Wodonga, eliminate sub-standard curves, improve grades, and pavement conditions.

Improved levels of safety on the new carriageways would result in substantial savings to both the local and regional community in accident costs. The new carriageway would be access controlled and therefore more energy efficient.

While fuel consumption varies with vehicle type, speed and road conditions, energy savings in terms of vehicle fuel savings are considered to be significant.

In assessing fuel consumption rate, average travel speeds of 105 km/h may be assumed for the travelling conditions on the proposed routes, while 74 km/h and 65 km/h may be taken as being the average travel speed on the existing Hume Highway through the open road and town, respectively.

Fuel consumption, shown in Table 21.2, has been estimated based on the average sized car consuming 0.133 L/km of travel on the existing section of road at an average speed of 70 km/h including stop/start conditions at a low level of service. With improved conditions and a constant speed of 105 km/h with no stops and a greatly improved level of service for traffic on the new route, the consumption rate would improve to an average of 0.10 L/km. Additional conservation of energy would occur with the recycling of unsuitable materials and of old pavement material, mulching and reuse of vegetation.

Table 21.2 -- Comparison of Fuel Consumption per Vehicle during Operation

Route	Length[1] (km)	Average Speed (km/h)	Rate of Fuel Consumption (L/km)	Fuel Consumed per vehicle over route (litres)
Existing	55.13	70	0.133	7.3
Outer	46.69	105	0.10	4.7
Inner	51.63[2]	105	0.10	5.2

Note: (1) for vehicles using the total route length for each option (Mullengandra to Barnawartha North)
(2) the length of the route comprises the inner route as proposed plus the distance between the end of the existing Hume Freeway at Wodonga and the point where the outer route joins the Hume Freeway at Barnawartha North

Average travelling time on the existing highway between Mullengandra and Barnawartha North is estimated to be 45 to 50 minutes, although this is highly dependent on the time of travel and the amount of traffic on the road. Construction of either the inner route or the outer route would approximately halve this journey time.

21.2.1 Outer Route

Between Sweetwater Road and Barnawartha North, the outer route is approximately 5 km shorter in length than the inner route, 9.5 km shorter than the existing alignment, and would have a saving in travel distance for through traffic. There would be significant savings in terms of average speed increase through the length of both inner and outer routes owing to the elimination of at-grade junctions, signalised intersections, substandard curves and upgraded pavement conditions.

From Table 21.2 it has been estimated that the outer route would generate a saving of 2.6 L of fuel per through vehicle. These fuel savings are considered substantial when multiplied by the traffic volumes which have been predicted to travel along the new route and form the basis for calculating net fuel consumption with the outer route forming part of the overall road system, as shown in Table 21.2.

21.2.2 Inner Route

The inner route is approximately 3.5 km shorter than the existing Hume Highway. Like the outer route, the savings in travel time, and vehicle fuel are considered to be significant. Access would be restricted onto the new alignment to allow free flow of traffic without significant delays caused by traffic signals and the delays caused by queuing in peak hours at the Lincoln Causeway.

From Table 21.2 it has been estimated that with improved conditions and a constant speed of 105 km/h with no stops, the inner route would generate a saving of 2.1 litres of fuel per vehicle. This forms the basis for calculating fuel consumption with the inner route forming part of the overall road system, as shown in Table 21.2.

21.2.3 Net Fuel Consumption

Net fuel consumption has been assessed as shown in Table 21.3 for the existing situation as well as the inner and outer routes. This is a gap calculation based on an average traffic flow through the study area. In reality, some sections of the route would be used by higher volumes of traffic while some sections would have lower volumes.

Additional fuel savings would be expected, particularly with respect to the inner route, due to the reduction of travel times for the high local traffic volumes using the portion of the route to gain access to various parts of Albury and Wodonga. These savings would not be available to the outer route. Both routes, however, represent positive savings in the use of fossil fuels and greenhouse gas emissions.

Table 21.3 -- Comparison of Net Fuel Consumption per Day during Operation

Route	Fuel Consumed per Vehicle (litres)	Vehicles per day using road system (1994)	Approximate Net Fuel Consumption per day 1994 (litres)
Existing	7.3	25,000	182,500
Outer	4.7	3,200 (through)(1) 21,800 (local on exist)	174,180(3)
Inner	5.2	3,200 (through)(2) 10,900 (local on inner) 10,900 (local on exist)	152,890(4)

Note: (1) Figures assume all through traffic would use the outer route. The balance of traffic would continue to use the existing route.

(2) Figures assume all through traffic would use the inner route. The balance of traffic would be distributed evenly between the inner route and the existing route.

(3) 3,200 vehicles at 4.7 litres/vehicles = 15,040 litres
21,800 vehicles at 7.3 litres/vehicles = 159,140 litres
Total approximate net consumption = 174,180 litres

(4) 3,200 vehicles at 5.2 litres/vehicle = 16,640 litres
10,900 vehicles at 5.2 litres/vehicle = 56,680 litres
10,900 vehicles at 7.3 litres/vehicle = 79,570 litres
Total approximate net consumption - 152,890 litres

The approximate net fuel savings per day for the outer route system compared to the existing highway system is some 8,300 litres per day. Given that a fuel tanker carriers an average load of 40,000 litres, the outer route fuel savings would be in the order of 60 tanker loads per year (assuming 300 days per year to allow for weekends). The approximate net fuel savings per day for the inner route system compared to the existing highway system is some 29,600 litres per day. This equates to a fuel saving in the order of 220 tanker loads per year.

In terms of total fuel consumption and savings, the outer route would require 47 million litres of fuel during construction and, based on the savings shown in Table 21.3, it would take some 14 years to generate fuel savings equivalent to fuel consumption during construction. The inner route would require 32 million litres of fuel during construction and, based on the fuel savings shown in Table 21.3, it would take some 3 years to generate fuel savings equivalent to fuel consumption during construction.

21.3 Conclusion

Approximately 6.7 million m^3 of earthworks are involved in constructing the outer route, while the figure is 4.3 million m^3 for the inner route. The range of construction methods and equipment used on this project would be similar to that used on other major road projects, although the inner route requires approximately 7 km less linear construction than the outer route and requires significantly less earthworks per kilometre. As the development of structures is similar on both routes, the overall energy usage during construction is less on the inner route (32 million litres of fuel compared to 47 million litres) and would be recouped in some 4 years compared to around 19 years for the outer.

Energy conservation would be achieved by using mainly concrete pavements, eliminating sub-standard curves and improving grades. It is estimated that fuel consumption for an average sized car would fall from 0.133 L/km to 0.10 L/km. The outer route would generate a saving of 2.6 litres of fuel per through vehicle, with the inner route saving 2.1 litres per through vehicle. System wide, these savings are in the order of 8,300 litres per day for the outer route system and 29,600 litres per day for the inner route system.

Chapter 22
Construction and Operation of the Project

Chapter 22 details the types and methods of construction to be undertaken should the project proceed. It outlines the likely program, staging, operations, earthworths, costs, materials and haulage routes.

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CHAPTER 22
CONSTRUCTION AND OPERATION OF THE PROJECT

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22.2 Outer Route
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22.4 Construction Methods
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22 CONSTRUCTION AND OPERATION OF THE PROJECT

Before construction work can commence, a number of major steps would need to be completed. These steps include:

- completion of the EIS/EES;
- project assessed by all governments prior to formal determination;
- approval by the Federal Government;
- finalisation of engineering drawings;
- completion of land acquisition process and compensation;
- the preparation of an Environmental Management Plan;
- secure all licences and approvals for construction works;
- development of contract documents;
- calling tenders and entering into contracts for construction of the work.

22.1 Construction Program

The design and construction of the work are estimated to take from 3 to 5 years to complete, depending upon funding. As the work would be undertaken by road contractors for the RTA and VicRoads, a detailed construction program would be generated during the tendering phase and formalised in the early stage of construction.

Target dates for the commencement of works would be affected by the completion of property acquisition and compensation processes, roadworks priorities, contract documentation, and a decision on the chosen route by the Federal Minister for Transport.

22.2 Outer Route

The work is likely to be divided into a number of stages as follows and shown in Figure 22.1.

Stage 1
From the interchange with the Hume Freeway to the Riverina Highway. The construction period is expected to be approximately 130 weeks duration.

Stage 2
From the Riverina Highway to Urana Road - Construction Period 130 weeks.

Stage 3
From Urana Road to Bells Road - Construction Period 100 weeks.

Stage 4
From Bells Road to Knox Road - Construction Period 60 weeks.

Stage 5
From Knox Road to Sweetwater Road - Construction Period 130 weeks.

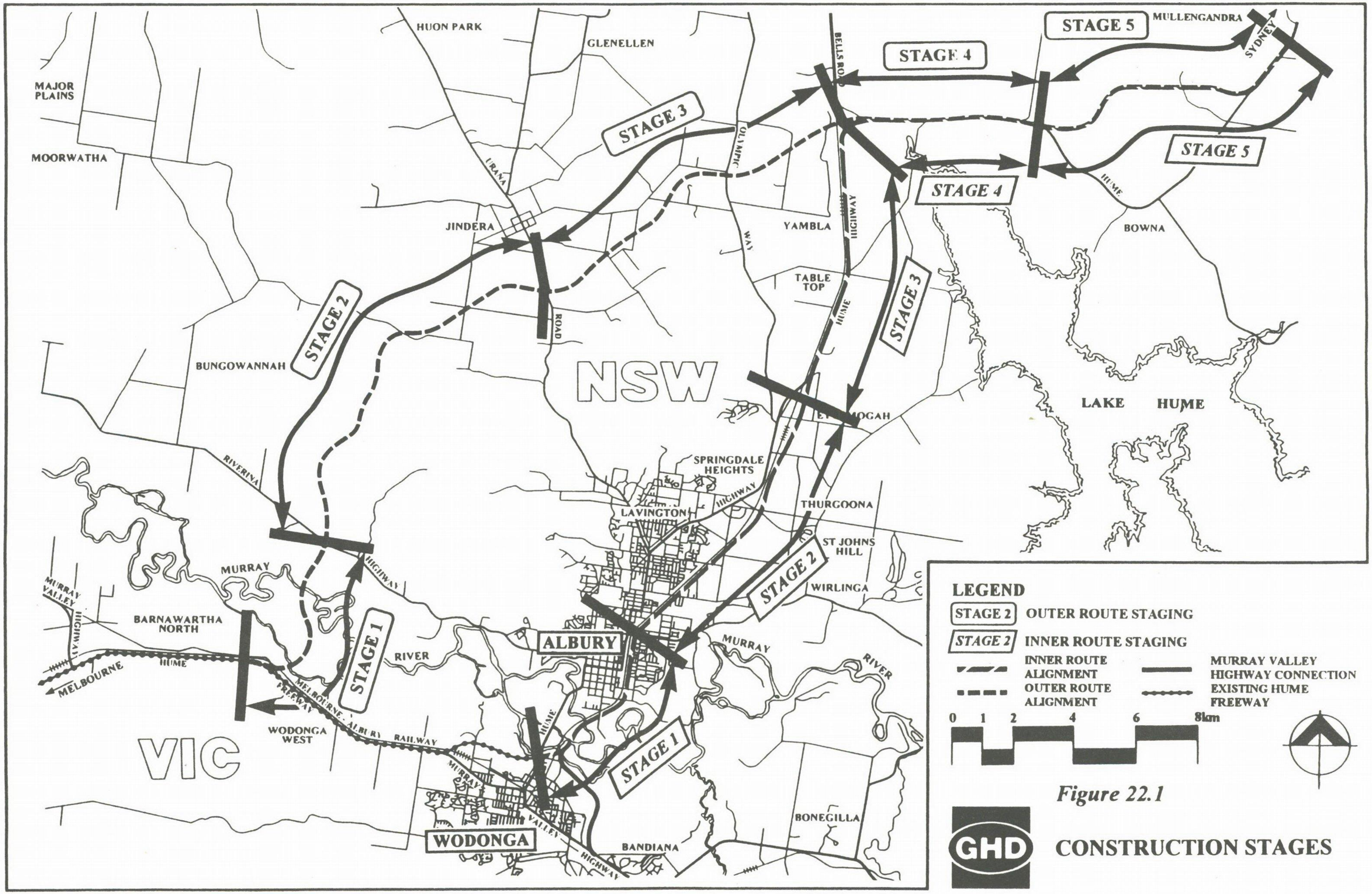

Figure 22.1

CONSTRUCTION STAGES

Staging

Stages relate primarily to the opening of sections of the new road traffic rather than the construction of works. The construction sequence and extent would be determined by what can be efficiently built, balancing of earthworks and funding rather than arbitrary limits. Accordingly, construction works are likely to overlap between stages of the route that would be opened to traffic. The likely stages and practices to be adopted during the construction period are outlined below. As the road is generally well away from the existing corridor, traffic switches are unlikely to be a major consideration except at interchanges.

The staged development has been described with the limitations of funding in mind, so that maximum benefit can be derived for one stage independent of the other stage.

It should also be noted that earthworks for any one stage may not be fully balanced and other sources of fill would then be required. These other sources of fill would include those discussed in Chapter 7 and borrow from other stages of the project.

Stage 1

This stage of work would involve approximately 5 km of construction between the Riverina Highway and the connection with the Hume Freeway. Discrete elements of the work are:

- Riverina Highway Interchange;
- roadworks between the Riverina Highway and Hume Freeway connecting ramps including extensive bridgeworks across the Murray River floodplain;
- southbound and northbound ramp connections with the Murray Valley Highway (if required);
- relocation of a local service road south of the Hume Freeway.

Construction of the work would require an estimated 1,820,000 m^3 of fill material for embankments. As only 445,000 m^3 of this is available from cuttings along this stage, a further 1,370,000 m^3 is required as borrow. Some 1,080,000 m^3 of borrow is available and would be imported from Stage 2 works. This means that elements of Stages 1 and 2 would overlap in time to avoid as far as possible any potential double handling of materials. The remainder of the earthworks requirement would be sourced from minor adjustments to longitudinal road gradings and road batters.

The construction of bridges at Riverina Highway, Wallace property access, Murray River main channel, four bridges over the Murray River floodplain, bypass over the northbound on ramp for northbound duals (Hume Freeway), railway and access road for southbound duals, bypass over the Hume Freeway, bypass over the northbound on ramp for southbound duals (Hume Freeway), railway and access road for northbound duals, Murray River floodplain bridge 4 for southbound off ramp, Murray River floodplain bridge 4 for northbound off ramp, are included in this stage of work. To enable the construction of the bridges at interchanges, a number of traffic switches are required.

Because of the need to take fill across the Murray River and other watercourses, the bridges would need to be constructed first. A development plan would be drawn up to manage the timing of bridge construction with cutting and spoiling.

Stage 2

This stage of work would involve approximately 13 km of construction from just north of the interchange with the Riverina Highway to and including the interchange with Urana Road. Construction of this section of road would commence in conjunction with Stage 1 in order to provide earthworks materials to construct embankments for the Murray River crossing. It includes construction of bridges over Urana Road, Luther Road, Bungowannah Road and creek, "Willow Grove" access and creek, dam in "Moorangury", and creek in "Moorangury".

Construction of this stage of work would require 1,750,000 m^3 of fill material. This material is available from cuttings along the same section of work with a significant quantity of rock which would require careful consideration of placement. An amount of 1,080,000 m^3 of material is available as surplus and would be most likely used in construction of the NSW side of Stage 1.

Stage 3

This stage of work would involve approximately 12 km of construction from just north of the interchange with the Urana Road to and including the interchange with Bells Road. It includes construction of bridges for grade separation of Table Top Road and Molkentin Road as well as the bridge required to carry Old Olympic Way over the new route, the Bells Road extension and the Main Southern Railway and access. Bridges are also required for access and creek crossing at Sandy Creek, and to carry the route over Bowna Creek.

Construction of this stage of work would require 1,200,000 m^3 of fill material. This material is available from cuttings along the same section of work. An amount of 250,000 m^3 of material is available for Stage 4 works if required after the completion of detailed designs.

Stage 4

This stage of work would involve approximately 15 km of construction from Bells Road Interchange to Knox Road. It includes construction of a service link for stock movement and a bridge over Table Top Creek.

Construction of this stage of work would require 440,000 m^3 of fill material. Some 105,000 m^3 of this material is available from cuttings along the same section of work. The remaining requirement of 335,000 m^3 is available from Stage 5 works.

Stage 5
This stage of work would involve approximately 9 km of construction from the deviation from the existing Hume Highway near Sweetwater Road to Knox Road. It includes construction of bridges over Mullengandra Creek and Newtons Road, as well as for access to Wright's property.

Construction of this stage of work would require 925,000 m³ of fill material. All of this material is available from cuttings along the same section of work. An amount of 335,000 m³ of material is available for Stage 4 works if required.

Alternative
An alternative staging proposal has been considered to allow full use of the work without the high level of cost associated with full development. The option is to develop the work as far as possible by complete construction of earthworks, drainage and fencing, but provide only sufficient pavement to allow two lane two way conditions with overtaking opportunities at a maximum 5 km intervals. This construction would result in a single carriageway with single bridge structures for the length of the work from Sweetwater Road to the Riverina Highway.

Dual carriageways would be provided south of the Riverina Highway to enable full construction of the bridges and ramps over the Murray River and connecting to the existing Hume Freeway in Victoria.

The work would be staged and constructed to allow upgrading to full divided carriageway conditions after the main work has been opened to traffic.

22.3 Inner Route

The work is likely to be divided into a number of stages as follows:

Stage 1
From the interchange with the Hume Freeway at the Lincoln Causeway to the Borella Road. The construction period is expected to be approximately 130 weeks duration.

Stage 2
From the Borella Road to Table Top Duals - Construction Period 130 weeks.

Stage 3
From Table Top Duals to Bells Road - Construction Period 100 weeks.

Stage 4
From Bells Road to Knox Road - Construction Period 60 weeks.

Stage 5
From Knox Road to Sweetwater Road - Construction Period 130 weeks.

Staging

The likely construction stages and practices to be adopted during the construction period are outlined below. As the road generally occupies significant lengths of the existing corridor each stage would contain a number of traffic switches, while at the same time accommodating the existing two way traffic.

The staged development has been described with the limitations of funding in mind, so that maximum benefit can be derived for one stage independent of the other stage.

Stage 1

This section of road is approximately 6 km in length and is located between the interchange with the Hume Freeway at the Lincoln Causeway and the interchange at Borella Road. The work would include:

- a full interchange at Borella Road;
- provision of a full interchange at Bridge Street;
- reconstruction of Bridge Street between Schubach Street and Ebden Street;
- provision of a second Murray River crossing;
- a new interchange at the existing Hume Highway, Wodonga;
- provision of a new connecting link to the Murray Valley Highway between Wodonga Creek and near Bandiana;
- construction of bridges at the Lincoln Causeway, over the new route at Borella Road, a pedestrian bridge at Dean Street, four road bridges at Bridge Street, rail underpass at Bridge Street, Murray River crossing, Murray River main channel, Flannagans Creek, Wodonga Creek, over railway and ramp, onloading ramp and offloading ramps to the Murray Valley Highway connection.

Construction of the work would require an estimated 1,600,00m³ of fill material for the embankments. It may be necessary to import up to 500,000 m³ of material for Stages 1 and 2 of the work from outside of the road corridor. The source of this material is likely to be the hill to the east of Albury Airport. Preliminary discussions have occurred with Albury City Council, the AWDC (owners of the land) and the Civil Aviation Authority. On the basis of this quarrying operation being properly managed, there would appear to be no objections from the owners to this as it would assist greatly the current operations of the airport and allow for future expansion to occur if necessary.

A geotechnical investigation was conducted on the Airport Hill borrow to test its suitability for construction purposes. The assessment indicated that the area would provide a suitable source of pavement fill. In addition, to provide for construction of the Bandiana link with the Murray Valley Freeway, it would be necessary to import some 560,000 m^3 of fill material from outside of the road corridor in Victoria.

Stage 2

This section of road is between Borella Road and the Table Top Duals. This stage of construction is approximately 11 km in length and would include:

- a connection from the new southbound carriageway to the existing highway involving a partial interchange, linking just north of "Billy Hughes Bridge";
- a full interchange at Thurgoona Road including a roundabout connection at the existing highway;
- a partial interchange at Dallinger Road including provision of a new connection between Union Street and Dallinger Road;
- a new service road between Fallon Street and North Street;
- a flyover of the new route at North Street.

Construction of a number of bridges is included in this stage of the works comprising bridges over the railway and new route at North Street, Dallinger Road/Union Road, Thurgoona Drive and at Seven Mile Creek.

Construction of the work would require an estimated 1,330,000 m^3 of fill material for embankments. Portions of this material would be provided from Airport Hill as described in Stage 1.

To enable the construction of the bridges required for interchanges, a number of traffic switches are required as detailed in Section 22.6.

Stage 3

This section of road is between the southern end of the Table Top Duals to Bells Road. The work is approximately 8 km in length and would include:

- construction of new alignment at the turn off at Bells Road;
- rehabilitation of the existing pavement on the existing dual carriageway section.

Construction of a bridge over Bowna Creek is included in this stage of the work.

Construction of the work is primarily rehabilitation of existing pavements, and minimal earthworks amounting to some 100,000 m^3 of fill.

To enable the construction of the work, a number of traffic switches are required to enable continued flow of traffic.

Stage 4

This stage of work would involve approximately 15 km of construction from Bells Road Interchange to Knox Road. It includes construction of a service link for stock movement and a bridge over Table Top Creek.

Construction of this stage of work would require 360,000 m^3 of fill material. Some 80,000 m^3 of this material is available from cuttings along the same section of work. The remaining requirement is available from Stage 5 works.

Stage 5

This stage of work would involve approximately 9 km of construction from the deviation from the existing Hume Highway near Sweetwater Road to Knox Road. It includes construction of bridges over Mullengandra Creek and Newtons Road, as well as for access to Wright's property.

Construction of this stage of work would require 925,000 m^3 of fill material. All of this material is available from cuttings along the same section of work. An amount of 265,000 m^3 of material is available for construction of Stage 4 works.

22.4 Construction Methods

Construction methods would be consistent with the requirements of the RTA's and VicRoad's technical specifications. Specific details of these methods are, however, to a large extent the prerogative of the successful contractor. The specification would contain as conditions of contract those matters requiring safeguard actions as identified in the EIS/EES.

As set out in Chapter 32 Monitoring and Management, an Environmental Management Plan would be developed by the RTA and VicRoads to ensure correct environmental management practices are adopted and used by themselves and their construction contractors. All efforts would be made to ensure that property owners, business operations and farm management activities are not adversely affected by the construction process. Safe and convenient access to and from affected properties and local roads for vehicles and stock would be maintained on a twenty-four hour basis.

Construction of carriageways would follow normal road making practices. Topsoil would be stripped and stockpiled by a front end loader and trucks, and drainage lines would be excavated by backhoes. After any necessary blasting, excavation of areas of cut would be undertaken by bulldozers and scrapers or excavators and trucks, with material being carted directly to areas of fill. This material would be compacted by roller and vibrating compacters then trimmed by graders. Mobile plant required during earthworks and carriageway formation would include bulldozers, scrapers, graders, front-end loaders, rollers, dump trucks, multi-lane concrete pavers, cranes, fuel tankers, water tankers and service trucks.

Cleared areas, earthworks, access roads, stockpiles and construction spoil disposal sites would be watered using water tankers to limit the potential for dust to occur.

Trucks hauling material for construction of other sections of proposed alignment would use the route alignment. Some pavement materials, or its constituents, may be required to be hauled from commercially operating quarries. The hauling of this material is dealt with in Section 22.11.

Total fill requirements for the five stages of the project amount to 7,300,000 m^3 for the outer route and 4,500,000 m^3 for the inner route, the majority of which can be obtained within the project area. A significant quantity of earthworks material would need to be found as "borrow" from places other than from the cuttings on the project. Approximately 500,000 m^3 may be required to be imported for the outer route, with 1,000,000 m^3 for the inner route. Where borrow is required from external sources appropriate environmental safeguards would be adopted in the Environmental Management Plan and all statutory requirements would be satisfied should sources other than present legally operating quarries be considered for use. Potential sources of material are discussed in Chapter 7.

Unsuitable material would be spoiled in low mounds and revegetated within the unused new road reserve.

Geotechnical conditions are such that all materials to be excavated from cuttings should be suitable for construction purposes. Design parameters of these materials would be determined by a rigorous sampling and testing program during the detailed design phase.

Construction difficulties would relate to excavation of some cuttings with unfavourable geological formation and construction over swampy riverine areas. Special methods for excavating difficult cuttings have been used elsewhere in similar circumstances and include such methods as rock bolting, surface facing and drainage.

Construction over swampy areas can be undertaken by use of suitable geotextile foundations, pre-consolidation and use of drains to avoid long-term settlement of embankments.

An estimated 400,000 m^3 of concrete would be required for the proposed works, most of which would form the pavement with minor amounts for bridgework and minor structures.

The final means of supply of concrete to the project would be at the discretion of the contractor. It is unlikely that ready mixed concrete would be available for much of the work except from on site batch plants. Owing to the specific requirements for pavement quality concrete required for the work, it is anticipated that an on-site concrete batching plant would be the preferred supply method, and would be located in the road reserve. Contractors would be required to obtain all relevant statutory approvals.

Manufacture of concrete and related products requires supply of fine and coarse aggregates. Supplies of suitable aggregates, readily available from various quarries in the region, would be hauled by truck to stockpile in the batching plant on site.

An effective program would be required for traffic switches, however only minimal works required for the construction of switching points would be constructed under, or close to, traffic. Any traffic switch areas would be constructed and signposted to the equivalent standard for two-way conditions.

Project water supply would be generally from local streams. In the event that there is insufficient local surface water available, the potential for water boring or haulage from the Murray River would be determined by road contractors. Consents and licences where required would be sought from the relevant authorities.

The allocation of compound sites for materials, plant and stockpile sites would be carried out by road contractors. These areas are often located within the road reservation, in parcels of severed land purchased by the RTA/VicRoads, or arrangements are sometimes made with property owners to lease property for such purposes during the construction period. Storage areas and compound sites would be located on cleared land, away from sensitive vegetation areas and water courses. The sites would also be located away from residences, hospitals, schools and other noise sensitive locations. The location of sites external to the road corridor would require consent from relevant local government authorities.

Information cannot be provided on a number of matters as these await contractual arrangements and would be determined by the contractor selected in association with the RTA/VicRoads and in adherence to the EMP guidelines. These include:

- the source, transport and assembly of plant and material;
- employment details;
- location of construction site facilities.

22.5 Earthworks

Staging requirements for construction of the project are such that borrow is required for completion of some stages in both routes.

Over the total length of the works a complete balance of earthworks would not be achieved, but the differences are minor in the context of the total project. A breakdown of preliminary estimates excavation and fill requirements for each stage of the work for both routes is as follows. The fill requirement for both routes would be primarily satisfied by excavation works within the route corridors and supplemented as required from external sources of material.

Stage	Requirement	Outer Route	Inner Route
Stage 1			
	Fill	1,820,000 m^3	1,600,000 m^3
	Pavement	260,000 m^2	205,000 m^2

Stage 2			
	Fill	1,750,000 m^3	1,330,000 m^3
	Pavement	290,000 m^2	275,000 m^2
Stage 3			
	Fill	1,200,000 m^3	100,000 m^2
	Pavement	275,000 m^2	165,000 m^2
Stage 4			
	Fill	440,000 m^3	365,000 m^3
	Pavement	125,000 m^2	125,000 m^2
Stage 5			
	Fill	925,000 m^3	925,000 m^3
	Pavement	215,000 m^2	215,000 m^2

Sufficient materials would be available to supplement borrow requirements and to replace material classified as unsuitable for embankment construction.

Any materials classified as unsuitable or surplus to requirements would be spoiled in low mounds and revegetated, or used to bench or reduce the side slope of fill batters to reduce excessive batter runoffs. Where appropriate, consideration would also be given to use of the material for construction of acoustic barriers and for enhancement of visual elements of the roadside by landscaping.

22.6 Traffic Management Required for Construction

To enable the work to be constructed while maintaining the flow of existing traffic, traffic would be switched between constructed portions of work using temporary connections between carriageways. Generally, existing carriageways through the work would be maintained in a two-way, twenty-four hour configuration with appropriate speed regulation until each stage of work is complete.

Both RTA and VicRoads require their contractors to manage traffic in accordance with Control of Traffic Specification. The intent of these specifications is to minimise delays to traffic, pedestrians and cyclists, both across and along the proposed route, as well as access to properties.

Appendix M is an extract from a typical specification.

22.7 Costs

Construction cost estimates include the cost of design, supervision, project management, and contingencies earthworks, bridge construction, pavement drainage, landscaping and ancillary works such as access restoration. Current estimates for a dual carriageway (i.e., two lanes in each direction) lane configuration at 1995 prices are as follows:

a) Outer Route -- dual carriageway

- Stage 1 : $84 million
- Stage 2 : $72 million
- Stage 3 : $37 million
- Stage 4 : $30 million
- Stage 5 : $32 million
- Other costs* : $ 8 million

Total Construction Cost: $263 million

Source: Sinclair Knight Merz, 1995 (Appendix J)

Note: *These include costs relating to pre-construction, land acquisition and compensation, retaining walls, and environmental services, over the whole project but they do not include items such as overheads or unsuitable material costs.

(b) Outer Route -- single carriageway

Estimates for the construction cost of a two-lane, two-way option for the outer route have also been provided by the RTA. These construction costs are based on:

- rehabilitation costs only for the section of the route between Bells Road and Knox Road (Stage 4);
- southbound carriageway pavement construction with full dual carriageway earthworks for the balance of the outer route;
- additional pavement costs to provide for 1 km of overtaking opportunity for every 5 km of travel in each direction;
- the exclusion of similar items and costs as noted for the 2x2 lane configuration.

The total construction cost for the two lane, two way option for the outer route is estimated at $189 million.

c) Inner Route -- dual carriageway

□	Stage 1	:	$69 million
□	Stage 2	:	$47 million
□	Stage 3	:	$17 million
□	Stage 4	:	$16 million
□	Stage 5	:	$32 million
□	Other costs*	:	$11 million
□	Bandiana Link+	:	$11 million

Total Construction Cost: $203 million

Source: Sinclair Knight Merz (Appendix J)

Note: * These costs relate to pre-construction, land acquisition and compensation, retaining walls, and environmental services, over the whole project.
+ These costs relate to imported fill required between North Street and Bridge Street, and for the Bandiana link with the Freeway, but do not include terms such as overheads or costs for unsuitable materials.

22.8 Waste Disposal

A relatively small proportion of vegetation would need to be cleared. Excess vegetation would be chipped or mulched on site and used in the landscaping/rehabilitation works. No burning of waste would be permitted.

Disposal of other waste material which cannot be utilised onsite, including contaminated material, domestic and human waste, would be in accordance with RTA guidelines, local council regulations and EPA requirements. Procedures for the disposal of waste material would be included in the EMP.

22.9 Hours of Construction

To minimise impacts of the construction process on property owners close to the new route, construction activities would be limited to 7.00 a.m. to 5.00 p.m. Monday to Saturday, subject to EPA (NSW) approval and agreement with local councils in Victoria.

No work would be permitted on Sundays or public holidays except in special circumstances such as when lane closures on existing roads are necessary. On these occasions, local residents likely to be affected would be notified by letter box drop prior to work commencing.

22.10 Construction Materials

The source of many of the construction materials would be dependent upon the suppliers used by the contractor selected to construct the works. Potential sources of borrow materials are listed in Section 7.4.4. The five principal construction materials required for the project are fill, sub-base, base course, concrete and asphalt surfacing:

Fill
All fill material required for the outer route is obtainable from excavations within the route corridor. As described in Sections 22.4 and 22.5, some individual stages would require borrow material from other stages but, overall, all fill material can be generated from minor adjustments to batters and gradients, negating the need to import fill material from outside the corridor.

Fill requirements for the inner route would necessitate the importation of some 1,000,000 m^3 of material. While the final question of material required would be minimised by minor adjustments to batters and gradients during the detailed design phase, it would still be necessary for external borrow sources to be utilised. Two borrow sites have been identified which are capable of meeting fill requirements. The first of these sites is the existing Brookes Quarry located off the Olympic Way at Ettamogah and owned by AWDC. The second source of material is known as the Airport Hill and is located 1,400 m due east of the runway at Albury Airport. Proposals have been formulated for the eastwards extension of the runway to accommodate larger aircraft but owing to aircraft safety requirements it is necessary for earthworks to be carried out to lower the hill located east of the runway. The hill is located on land owned by AWDC.

Sub-base
Depending on the quality of material excavated, sub-base material could be obtained within the corridor for both the inner and outer routes. Alternative and supplementary sources of material are listed in Section 7.4.4.

Base Course
Some of the requirements for base course could be met from materials excavated within the corridor for each of the route. Any such material could be augmented by the importation of material from sources listed in Section 7.4.4.

Concrete
Coarse aggregate, gravel and sands for concrete could be obtained from the sources identified in Section 7.4.4. Depending upon the method adopted by the contractor selected to construct the works, concrete may be batched off site and trucked on site or a temporary batching plant could be established on site.

Asphalt Surfacing
The main carriageway pavements would be of a rigid concrete type. In order to reduce tyre noise in close residential areas between Bridge Street and Borella Road, an additional surface layer of open graded asphaltic concrete may be applied. However, numerous ramps, access roads, service roads and 'tie-ins' to existing roads would utilise bitumen products such as seals, asphaltic concrete, also to assist in reducing tyre noise.

22.11 Construction Traffic

The use of the existing road network by construction traffic would generally involve delivery of construction equipment, access for construction workers, and delivery of new use materials for incorporation into the works. It is expected that the roads most frequently used by construction traffic would be those trunk roads close to the proposed works.

In the case of the outer route these would include:

- Hume Highway/Freeway (existing)
- Riverina Highway
- Urana Road
- Olympic Way

In the case of the inner route these would include:

- Hume Highway/Freeway (existing)
- Murray Valley Highway
- Borella Road

Relocation of existing materials along the route corridor would generally involve earthworks materials where surplus materials from one stage of construction are required for construction of the next. In these cases, road crossings would be required for haulage vehicles, and traffic management techniques such as flag control or "boom gates" would be employed to ensure the safe passage of trunk road users. Minor delays to road users may occur as a result of these activities.

When interchange structures are completed and approach earthworks are in place, construction traffic would be able to use the new work to gain access across intersecting routes; however, new product suppliers would still be required to use the existing road network to access the site.

Haulage from Borrow Areas

Delivery of earthworks materials from borrow areas would be the most significant individual haulage activity owing to the nature of the materials being moved. Borrowing of earthworks materials from newly established areas such as Airport Hill, would require special arrangements to suppress dust during extraction and haulage.

Haul roads for this borrow site would be established on airport property to avoid interference with flight patterns. From Airport Hill there is direct access to the inner route corridor without using the local road system. A detailed haul road location would be agreed between the Constructor and airport management, but it would most likely following the northern airport boundary, cross Elizabeth Drive and an open drain near Jelbart Street. Traffic management would be established where the haul road crosses Elizabeth Drive to ensure safe transit by local road users and trucks. A suitable drainage structure would be required to cross the open drain.

Constructors would be required to establish and keep a dust free surface on the haul road by either bituminous sealing or by watering to maintain a continuously damp surface. In addition, individual loads may need to be dampened prior to transit or protected from dust emission by some other means.

Materials hauled from Brook's Quarry to the proposed inner route alignment near Ettamogah would be delivered to the route as required using Olympic Way and the existing Hume Highway. Normal compliance with requirements of statutory authorities and local government is required, however no other special provisions are expected to be required.

The location of these borrow sources and haulage routes is shown in Figure 22.2.

22.12 Inspection, Maintenance and Operation

Regular maintenance patrols by the RTA and VicRoads of the highway would ensure that the carriageways and verges of the road corridor are maintained in a condition appropriate for high speed and safe vehicular travel. Inspections would also be carried out on the bridge structures which would include all major structural elements such as the piers, deck, guardrails and paintwork.

From time to time repairs or maintenance may be necessary to facilities such as the road surface, drainage, signposts, guardrails or barrier kerb, landscaping, lighting, emergency phones and stock underpasses. Any such work would normally be carried out in daylight hours if possible, with appropriate warnings to traffic.

22.13 Conclusion

Construction of the project would take from 3 to 5 years and depending on funding be undertaken by contractors and broken down into stages a number of which would overlap. Target dates for commencement would be affected by the completion of the property acquisition and compensation processes, roadworks priorities, contract documentation and a decision on the chosen route by the Federal Minister for Transport.

Approximately 5,300,000m^3 of earthworks would be required for the inner route, and 7,300,000m^3 for the outer route. The estimated construction costs for the inner and outer routes are \$203 million and \$263 million respectively for a two by two lane configuration. A single two lane, two way option for the outer route with overtaking lanes has an estimated construction cost of \$189 million.

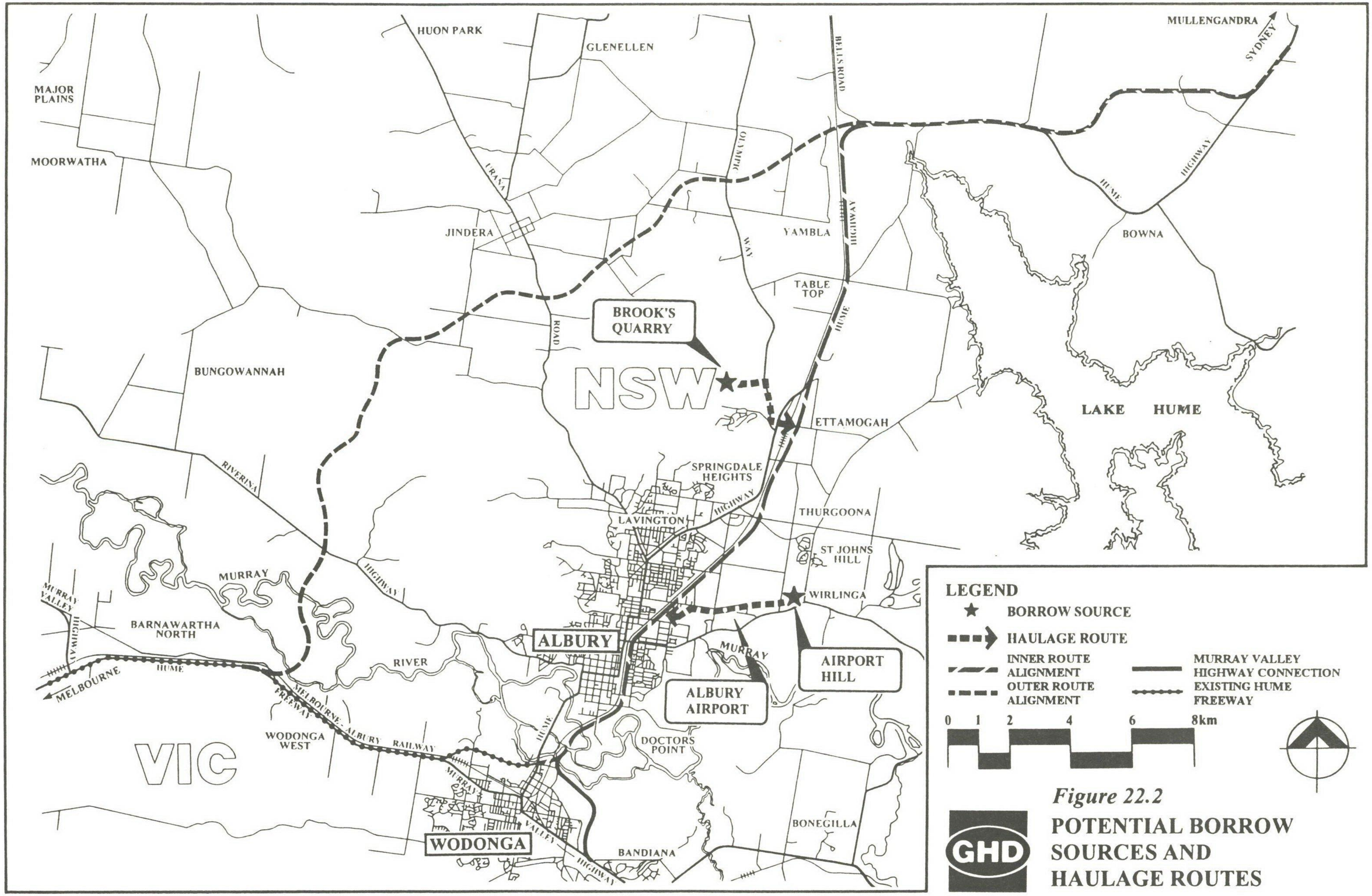

Figure 22.2

POTENTIAL BORROW SOURCES AND HAULAGE ROUTES

Chapter 23
Operational Hazards and Risk

The information in this section is taken from the 'Risk Assessment of Hazardous Goods Transportation on Potential National Highway Routes in the Albury Wodonga Region', by Ren Mahant, ALARA Risk Management Services. An unabridged version of this report is presented in Working Paper 10.

This chapter focuses on the potential hazards of construction and operation of the inner and outer routes of the Albury Wodonga National Highway. This chapter looks at the potential hazards of bulk road-carrier accidents.

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CHAPTER 23

OPERATIONAL HAZARDS AND RISKS

23 OPERATIONAL HAZARDS AND RISKS

23.1 Introduction

The discussion in this chapter is arranged according to the method used to determine the likelihood of risk arising from the movement of hazardous goods. It involves:

- the identification of land uses and environmentally sensitive areas adjacent to the existing route and the new routes (inner and outer);
- the identification of hazardous goods likely to move through or into the study area;
- the probability of a spillage occurring in an accident;
- the likely consequences of a spill;
- the likelihood of an accident occurring;
- an overall assessment of risk bringing the above together;
- conclusions and summary of the likelihood of a major event relating to the movement of hazardous goods.

The hazard and risk study was undertaken for both the inner and outer routes proposed for the Albury Wodonga National Highway Project. A hazard is defined as a physical situation with a potential for human injury, damage to property, damage to the environment or some combination of these. In transportation risk analysis, a hazard would be that due to the loss of a containment of dangerous goods. Hazard analysis therefore is the identification of undesired events that lead to the hazard, and the analysis of the mechanisms by which these events could occur. Risk is defined as the likelihood of a specified undesired period (usually one year).

This section presents the findings of the risk assessment of the transport of dangerous goods on the two highway options and a comparison with the Do Nothing option. Risk assessment is the quantitative evaluation of the likelihood of undesired events and the level of harm being caused, together with value judgements made concerning the significance of the results.

The objective of the chapter is to provide an evaluation of risks associated with the transport of dangerous goods on the two route options that could result from accidental release of these materials and cause harm to the environment or public health. The purpose is to assess the transportation risks for the inner and outer routes on a common basis so that a comparison may be made between the two options and the existing route through Albury and Wodonga.

The two route options were divided into segments according to the adjacent landuse and population density, environmental vulnerability and traffic characteristics. The existing Hume Highway route through Albury was also divided into segments similar to the inner route to provide a base case for comparison. Various accident scenarios were postulated for each segment and the extent of their effects were estimated. The effects were evaluated in terms of the potential of the released dangerous goods to injure the exposed residents and other people in the vicinity of the proposed and existing routes.

According to NSW DoP guidelines, transportation risk analysis is concerned with risk to surrounding people, property and the natural environment. It is recognised that people directly involved in the accidents and a number of other road uses could be injured or even killed. This impact would be common to both the alternative routes and does not affect the comparison.

The major effects of accidents involving vehicles carrying dangerous goods in bulk that could cause serious injury or fatality to people considered in this study were:

- thermal radiation of a fire of flammable liquid spilt in an accident and a fireball of liquefied flammable gas released in an accident;
- explosion overpressure caused by a vapour cloud of compressed liquefied flammable gas;
- injury from exposure to toxic gas.

Dangerous goods which, if released, do not injure people but may affect the local environment were also considered. The most significant areas of concern are the Hume Reservoir, Murray River and the floodplain. Environmental risks were described as the quantity of the dangerous good released to the receptor (for example acid or caustic or other corrosive liquid, flammable liquids liquid poisons or toxics against the likelihood of release).

The likelihood of accidents was determined from a review of the historical data of accidents, the predicted traffic volumes along the selected segments of the two options, the predicted accident rates in the area, road design features of the existing urban roads and the proposed highway and other factors considered relevant. In estimating the dispersion of toxic and flammable gases in the air, the wind weather conditions that are likely to give the maximum consequence distances were assumed. Albury weather is characterised by relatively stable conditions and low wind speeds. This assumption was considered appropriately conservative as at higher wind speed and instability, gases would disperse more quickly and over shorter distances.

In accordance with the guidelines, risk was evaluated as the combination of the possible number of people that could potentially be affected by each hazardous event and the probability of the event. This was calculated for each defined segment and summed up to give the total risk for each route.

Methodology of Transportation Risk Analysis

The methodology adopted in this risk assessment is based on the methodology outlined in the *Guidelines for Land Use and Environmental Safety Planning for Hazardous Materials - Road Transport Considerations* issued by the Department of Urban Affairs and Planning.

The methodology used differs from the methodology employed in risk analyses of fixed installations for the purposes of land use planning decisions, as specified in DUAP's *Hazardous Industry Planning Advisory Paper 4 Land Use Planning Safety Criteria.* In the methodology for risk analysis of fixed installations, the individual risk of fatality to the exposed person in the land surrounding the hazardous installation is expressed as the chance in a million per year at the specified levels in the form of contours around the installation and societal risk is expressed as a curve of the number of fatalities against the frequency of occurrence. In risk analysis studies of fixed installations, it is normal practice to compare the individual risk of fatality of the exposed individual with common every day risks that people face and appear to accept, for example, smoking, crossing the road, flying, etc.

In the selected methodology transportation risk is expressed as the probable number of fatalities per year applicable to the subject route which is similar to the concept of societal risk rather than the concept of the individual risk. The results of transportation risk analysis are not comparable to the normal every day risks that people appear to accept. The important point is that the selected methodology provides a useful basis for comparison between options.

In this assessment, risk quantification of each alternative route was obtained by combining the estimated number of people in the residential areas who may be exposed to the effects of dangerous goods released in an accident and the likelihood of the incidents for each route. Risk from the existing Hume Highway route through Albury Wodonga was also evaluated as a base for comparison. Risks to the people involved in the accident and other road users are normally not included in such analysis. The number of people who may be exposed to the effects of the identified incidents was based on the typical population densities for rural and urban population levels and was increased for areas that include schools.

23.2 Adjacent Landuse and Environmentally Sensitive Areas

23.2.1 Segmentation of the Routes

Existing Hume Highway Route

For the purposes of the analysis, the existing Hume Highway route was broken up into segments similar to the inner route as follows:

Segment 1 (ERS1): Extends from the Bells Road to Union Road near the Racecourse. Length is 17 km.

- The existing highway turns south from its east-west alignment at Bells Road.

- Continuing southwards, the route passes the towns of Table Top and Ettamogah, as well as a number of isolated homesteads.

- The land within this segment is predominantly rural, with lots becoming smaller as Albury gets closer.

Segment 2 (ERS2): Extends from Union Road to Borella Road. Length is 3 km.

- Passes by North Albury and Alexandra Park, including rural, industrial and residential land.

- The existing highway runs immediately adjacent to the Main Southern Railway.

Segment 3 (ERS3): Extends from Borella Road to Ebden Street. Length is 3.1 km.

- As in Segment 2, the highway runs parallel to the railway. In this case, the Albury Railway Station Yard.

- Besides infrastructure associated with the railway, the existing highway bisects the Albury town centre and East Albury. A number of the nearest residences have been purchased by the RTA.

Segment 4 (ERS4): Extends from Ebden Street, over the Murray River and along High Street. Length is 4 km.

- The existing highway passes through a mixture of landuses in the southern part of Albury.

- The route crosses the Murray River floodplain across a series of bridges.

- Following the crossing of the Murray, the highway enters the northern part of Wodonga, passing through a variety of landuses, including residential, commercial and industrial.

Inner Route

Following the inner route from the north to south, the adjacent land uses and environmentally sensitive areas were identified in consultation with the Albury City Council and the Environment Protection Authority, Albury.

For the purposes of the analysis, the inner route was broken up into five segments as follows:

Segment 1 (IRS1): Extends from the Bells Road to Union Road near the Racecourse. Length is 16 km.

- Land to the east extending from Bells Road to the Race Course is zoned rural.

- The Hume Reservoir, which is considered to be environmentally sensitive is about 2 km to the east between Bells Road and Yambla. The road level in this area is lower than the Hume Reservoir. The northern part of the route at Bowna Creek bridge is at a higher elevation than the Hume Reservoir and is common to both the existing road and the proposed routes. This part of the road is the only drainage route for any spills to the Hume Reservoir.
- Land to the west is zoned rural and industrial and is largely undeveloped at the present time.
- The nearest residences in Springdale Heights to the west are 1 to 1.5 km away.
- The nearest residences in Lavington to the west are about 0.3 km away.
- The nearest residences on the east in Thurgoona are about 1 km away.
- There are eight schools in the area but they are located approximately 1 km of the route in Thurgoona to the east and over 1 km away on the western side.

Segment 2 (IRS2): Extends from Union Road to Borella Road. Length is 3.3 km.

- The eastern side is largely industrial about 0.3 km away.
- The western side is largely residential and extends about 4.5 km to the west.
- Airport is to the east about 1 km away.
- Racecourse is about 0.5 km away to the east.
- On the eastern side, residences north of Borella Road and east of Alexandra Park are about 0.5 km away.
- Land on the western side includes a mix of residential zone with pockets of light industry. Residences in the suburb of North Albury are about 0.5 km away.
- There are five schools in the area in North Albury and Albury.

Segment 3 (IRS3): Extends from Borella Road to Bridge Street. Length is 2 km.

- Land on the eastern side is zoned residential and extends about 2 km to the east.
- Land on the western side is zoned general business (commercial) and includes some residential areas.
- A hospital (169 beds) in East Albury about 1 km from the route.

- One old age home and five schools are located in the area generally on the western side less than 1 km away.

- Albury Railway Station is located adjacent to the route in this segment.

Segment 4 (IRS4): Extends from Bridge Street, over the Murray River and up to the point where it joins the existing the Hume Freeway. Length is 3.2 km.

- Land on the eastern side between Bridge Street and the river bank is rural farming land and is part of the floodplain, which is considered environmentally sensitive.

- Land on the western side of the route on the north bank is zoned industrial but includes a pocket of residential area about 0.2 km away.

- The Murray River and the floodplain are considered environmentally sensitive.

- The route passes through zoned rural lands.

- Industrial land and residences in the north of Wodonga are found immediately adjacent to the road reservation.

Segment 5 (IRS5): Defined as the branch on the southern bank of the river which joins the Murray Valley Highway. Length is 3.5 km.

- This segment is flanked by the floodplain on both sides. Residential zone is located about 1 km to the south and west.

- The nearest school is a pre-school in Belgrave Avenue about 1 km away.

Outer Route

Following the outer route from the north to south, the adjacent land uses and environmentally sensitive areas were identified in consultation with the Hume Council and the Environment Protection Authority (EPA), Albury.

The outer route was then broken up into two segments as follows:

Segment 1 (ORS2): Extends from the Bells Road to the bank of the Murray River. Length is 25 km.

- The entire route passes through rural land.

- The nearest densely populated residential area is Jindera with a population of 800 approximately 2 km to the north and west of the route. Also, there are a number of individual homesteads scattered in the area of the route, some of them as close as 150 m.

- The land adjacent to the route is used mostly for grazing sheep and cattle.
- Some light industry is located near Jindera between the route and the township.

Segment 2 (ORS2): Consists of the river crossing and extends to he point where it joins the existing Hume Freeway. Length is 4 km.

- The river and the flood plain are considered to be environmentally sensitive.
- There are no residential areas near the route, but there are a number of scattered individual residences in the area of the route.

23.2.2 Relevant Highway Design Features

The aspects of the existing Hume Highway route that obviously contribute to the current accident rate are:

- large number of stop/giveway type intersections;
- large number of intersections with traffic lights;
- many sharp bends;
- roadside objects such as poles, telephone booths and parked vehicles.

Both of the proposed routes are designed as highways incorporating aspects that would virtually eliminate the likelihood of accidents of the type currently being experienced on the existing Hume Highway and other highways and roads throughout Australia. These highway features are:

- divided carriageways;
- hard shoulders and no roadside objects such as poles;
- no steep grades;
- long radius bends;
- at grade intersections with adequate merge distances;
- speed monitoring and warning signs.

23.2.3 Population Levels

Population levels in the residential zones are assumed to be eight to ten households per hectare or twenty-eight persons per hectare. This would apply at night time as the number of persons at home during the day time would be expected to be less.

Population level in the industrial areas is assumed to be ten persons per hectare. This applies to normal working hours.

Population level in the mixed industrial and residential zones has been assumed to be 20 persons per hectare or less according to the relative proportions of the two zonings.

Rural area population is assumed to be three persons per hectare.

School population is assumed to be 200 on average.

23.2.4 Existing Emergency Services

Albury is well served by emergency services that may be required for road transportation incidents involving dangerous goods. The inner route appears to incorporate adequate access points from the city. It is assumed that the outer route would include similar access points from the city. The time taken to respond to an emergency on the outer route would clearly be longer than the inner route because of the longer distance. It is assumed that a number of emergency telephones would be provided along the routes.

There are two fire brigades within Albury that can respond to the southern parts of the inner route. Fire brigades are also located at Lavington in the north and in Wodonga to the south.

Police, hospitals and ambulances are located within easy reach of the inner route.

The NSW Environment Protection Authority (EPA) has developed emergency plans for handling emergency situations and is supported by a regional office in Albury. EPA's HAZMAT plan (hazardous materials) defines the roles and responsibilities of various authorities in an emergency involving hazardous materials. EPA is defined as a support agency in the combat phase of the emergency and provides specialist advice to the fire brigades and other authorities. In the clean-up phase, EPA is the lead agency and responsible for coordinating others. The ENVIROPLAN has been developed for Statewide emergencies but has not yet been developed for the district level. The EPA officers at Albury carry mobile phones and can be contacted by a paging system.

The State Emergency Services (SES) has an office in Albury and is also supported by the Albury Volunteer Rescue Service.

23.3 Hazard Identification

23.3.1 Hazards Considered

Hazards are those that are considered to be of sufficient magnitude and have the potential to affect people in the populated areas near the routes or those that may affect environmentally sensitive areas. The guidelines suggest the threshold quantities of different classes of dangerous goods that should be considered in transportation risk assessment. Table 23.1 provides a summary of the potential hazards arising from accidents with bulk carriers.

Table 23.1 -- Potentially Hazardous Substances Transported in Bulk Road Carriers and their Potential Effects

Hazard	Class	Substance	Effects of Release
Flammable liquids	3	Oil products such as diesel and petrol in road tankers ranging from 14,500 L to 40,000 L.	Fire and/or Environmental Pollution
Compressed Liquefied Flammable Gases	2.1	LPG in road tankers ranging from 7,000 kg to 20,000 kg.	Fire ball on immediate ignition, vapour cloud explosion or a flash fire in the event of delayed ignition.
Compressed Liquefied Toxic Gases	2.3	Ammonia in road tankers with a maximum of 20 tonnes.	Toxic effects on people.
Oxidising Agents	5.1	Hydrogen peroxide.	May start fires or increase the violence of a fire, would cause environmental pollution.
Corrosive Substances	8	Various	Environmental Damage
Poisonous Substances	6	Various	Environmental Pollution

23.3.2 Hazards Description

Flammable Liquids (Class 3)

Oil products such as petrol and diesel are carried in road tankers in sizes ranging from 14,500 L to 40,000 L. If the standard is taken as being 40,000 L with a number of internal compartments, in the event of an accident, the oil spill would form a pool on the road surface the shape of which would depend on the road features. A large spill may be followed by either a fire of the pool if a source of ignition is found, or, if there is no ignition, the oil product could drain into the stormwater sewer and cause environmental pollution.

Compressed Liquefied Flammable Gases (Class 2.1)

LPG is transported in bulk by road tankers of a variety of sizes ranging from 7,000 kg to 20,000 kg. Since LPG is liquid only when under pressure at atmospheric temperature, the impact energy required to cause a rupture of LPG tank is much greater than that for a petrol tanker.

The hazards of an LPG tanker accident considered were:

- In the event of immediate ignition – a fire ball of the quantity of LPG released some of which will be in the vapour phase and some in the liquid phase. Thermal radiation of a fire ball could injure and kill people.

- In the event of delayed ignition – vapour cloud explosion or a flash fire. Explosion overpressure of a vapour cloud explosion could injure and kill people.

- In the event of no ignition – dispersion of the vapour. This will not harm the people or the environment.

Other hazards of LPG such as jet fires and Boiling Liquid Expanding Vapour Explosion (BLEVE) were not considered likely scenarios in the case of road accidents.

Propane is not considered an environmental hazard. Its products of combustion are carbon dioxide and water vapour which are not hazardous to the local environment.

Compressed Liquefied Toxic Gases (Class 2.3)

Ammonia was selected as the representative toxic gas for harmful effects on the people. Other toxic gases are not likely to be involved in road accidents in the road routes under consideration.

Ammonia vapour, even at low concentrations in air, produces a sensation of suffocation and quickly causes burning of the respiratory tract which, on prolonged exposure, may result in death. The anhydrous liquid causes severe burns on contact with the skin. Hazards of ammonia considered were the release of the gas from a road tanker which may rupture as a result of an accident.

Anhydrous ammonia is transported in road tankers in bulk in 20 t in pressurised liquefied form. The hazard considered is that of a road tanker being ruptured in a road accident and releasing all of 20 t of liquefied ammonia.

Pure ammonia vapour is lighter than air and would disperse upwards into the air, but if released from a bulk tanker in liquefied form it forms an aerosol and the mixture of vapour and aerosol is heavier than air so that it disperses initially like a heavy vapour.

Toxic effects on people depend on the concentration in air and the period of exposure. For the purposes of this analysis, the dispersion of ammonia has been evaluated up to a concentration considered to be immediately dangerous to life and death (IDLH) of 500 ppm.

Oxidising Agents (Class 5.1)

Oxidising agents will liberate oxygen which may start a fire in other materials and may increase the violence of a fire. The known material in this class is hydrogen peroxide (59.5%) used by the Australian Newsprint Mills.

Pure hydrogen peroxide can decompose violently if brought in contact with dirt or certain metals. However, hydrogen peroxide imported by the Australian Newsprint Mills is 59.5% strength and is unlikely to cause a fire or explosion.

Environmental consequences of hydrogen peroxide are not clearly established. It is assumed that any spills of this class of dangerous goods would cause environmental pollution.

Corrosive Substances (Class 8)

Hazards of these substances considered in this analysis are those resulting from spills and releases from road accidents and could cause environmental damage.

Poisonous Substances

Hazards of spills of this class of dangerous goods in liquid form were treated as causing environmental pollution.

Radioactive Materials (Class 7), Infectious Substances (Class 6.2) and Explosives (Class 1)

Dangerous goods of these classes have not been considered as these are subject to stringent legislative requirements and regulations. However, this report recommends that consideration be given to restricting normal traffic on the causeway when explosives are being transported over it.

Existing controls on the transportation of radioactive materials, infectious substances and explosives should be reviewed and consideration should be given to restricting other traffic on the Murray River crossing when explosives are being transported over it.

Other Materials

There is a range of other materials such as milk that are not classified as dangerous goods but could potentially affect the environment. These have not been considered.

23.4 Probability of Loss of Containment in a Road Accident

23.4.1 Description of Probabilities

It is recognised that strict codes and regulations govern the carrying of dangerous goods on roads, all directed at the safe containment of goods. If a road tanker carrying dangerous goods is involved in an accident, then whether the damage is severe enough to cause loss of containment or not depends on a number of factors such as the location and direction of impact and the energy of collision. Indeed, there is a greater probability that a loss of containment would not occur. If it does, then a variety of consequences may follow depending on the physical properties of the material released. In this section, the probability of loss of containment and the type of consequences that may ensue are examined. The probabilities have been developed from a review of:

- previous five year history of road accidents in the area including the Hume Highway in both NSW and Victoria - (acknowledgment: data supplied by the RTA in NSW and VicRoads in Victoria);

- definitions for Coding of Accidents (DCA) which classify each recorded accident - (as incorporated in the data supplied by the RTA and VicRoads);

- road design features of the existing roads and the proposed highway routes;

- the strict codes and regulations that govern the carrying of dangerous goods on road;

- an assessment of the characteristics of an accident, the engineering safety design features of the vehicles and containers, including the physical properties of the materials and other factors.

23.4.2 Summary of Probability

Table 23.2 provides a summary of potential accident scenarios occurring in relation to the various hazardous materials transported in bulk road carriers.

It also provides a summary of probabilities of the potential scenarios that may follow if such an accident occurs.

Table 23.2 -- Hazard Probabilities

Hazardous Material	Class	Road Type	Potential Accident Scenarios	Probabilities
Flammable liquid	3	Urban	Probability of a fire spill	0.08
			Probability of a spill without fire	0.08
			Probability of no spill and no fire	0.84
Flammable liquid	3	Freeway	Probability of fire of the spill	0.2
			Probability of a spill and no fire	0.02
			Probability of no spill and no fire	0.78
Flammable Liquefied Gas	2.1	Urban	Probability of a fireball	0.02
			Probability of a vapour cloud explosion	0.01
			Probability of loss of containment and harmless dispersion	0.01
			Probability of no loss of containment	0.96

(Table continued over)

Table 23.2 -- Continued

Flammable Liquefied Gas	2.1	Freeway	Probability of a fire ball	0.08
			Probability of a vapour cloud explosion	0.005
			Probability of loss of containment and harmless dispersion	0.005
			Probability of no loss of containment	0.91
Toxic Gas	2.3	Urban	Probability of Toxic Gas Release	0.02
			Probability of no loss of containment	0.98
Toxic Gas	2.3	Freeway	Probability of toxic gas release	0.09
			Probability of no loss of containment	0.91

The classes of dangerous goods covering explosives, radioactive substances and infectious substances are excluded from the study because they are subject to special controls and legislation that is considered to be beyond the scope of a risk assessment of this type. This report recommends that the existing controls on their transportation be reviewed and consideration be given to restricting normal traffic on the causeway when explosives are being transported over it.

23.4.3 Potential Incident Scenarios

The following represent potential incident scenarios:

A Loaded Road Tanker Accident on Urban Road -- Flammable Liquid (Class 3)

This type of accident is likely to be a low speed accident and the likelihood of loss of containment would arise from a collision which may then lead to a spill and a fire of the pool of the liquid on the road surface. This scenario applies to the existing Hume Highway route through the city.

Collision types considered were:

- front of the tanker
- rear of the tanker
- side of the tanker
- tanker running out of control and hitting a roadside object.

The probabilities used reflect the likely speed and therefore the collision energy. The probability that the collision would rupture the tank would be greater for a collision to the side of the tanker rather than to the front or the rear of the tanker. The probability of ignition has been assumed to be relatively high because of the likely presence of people, other vehicles and nearby houses and shops.

The resulting probabilities are shown in Table 23.2.

A Loaded Road Tanker Accident on Freeway -- Flammable Liquid (Class 3)

The characteristics of an accident on a freeway would be quite different to the scenarios for the urban roads. The vehicle speeds are likely to be high and the initiating cause could be the vehicle running out of control. This type of accident applies to the two alternative route options.

The scenarios considered were that:

- tanker could run out of control and roll over;
- collide with a roadside object (low probability);
- collide with another vehicle travelling in the opposite direction (small chance because of the separated carriageways).

Relatively high speed implies a higher probability of tank damage and spill. Also, the probability of ignition would be higher because of the sparks that may result from the high speed. The resulting probabilities are shown in Table 23.2.

A Loaded Road Tanker Accident on Urban Road or Freeway -- Flammable Liquefied Gas (Class 2.1)

On urban roads or freeways the collision energy is likely to be low and, in conjunction with the robust pressure vessel design, the probability of loss of containment is relatively low. The probabilities of the various consequences for both the urban road and freeway situation following an accident are shown in Table 23.2.

A Loaded Road Tanker Accident on Urban Road or Freeway -- Toxic Gas (Class 2.3)

Similar reasoning as stated above applies and the emerging probabilities are shown in Table 23.2.

Loaded Tankers Carrying Other Classes of Dangerous Goods

The probability of damage and spill from tankers carrying Class 6 and Class 8 goods was assumed to be similar to the oil product tankers.

23.5 Consequence Analysis

Potential Effects on People

The evaluated consequences address potential effects on people in the areas adjacent to the proposed routes and not people directly involved in the accident or other road users. The inclusion of the number of people involved in the accident and the other road users has been avoided because it would be a common factor in all alternatives and does not affect the comparison.

The inner route is separated from the residential areas by over 300 m for most part, except for a number of residences in the East Albury area. An estimate of the number of people exposed takes this separation distance into account.

Release Scenarios

The following simplifying assumptions were made:

- The loss of containment results in instantaneous release of the contents of the road tanker.
- The release quantity is the full quantity of a standard road tanker (20 t).
- Dangerous goods of each class are represented by one product in each class as follows:
  - Class 2.1: 20 te of Propane
  - Class 2.3: 20 te of Ammonia
  - Class 3.1 and 3.2: 40 kL of petrol

Although chlorine is much more toxic (lethal dose is 50 ppm), it is transported in standard 920 kg drums on normal trucks in accordance with the stringent chlorine handling requirements. In the worst case scenario of an accident involving a truck carrying chlorine drums, the maximum credible release quantity of chlorine is 920 kg. The representative toxic gas has been assumed to be 20 te of ammonia because dispersion of 920 kg of chlorine indicated that under similar wind weather conditions, the extent of 50 ppm concentration of chlorine would not exceed the extent of 500 ppm concentration levels owing to 20 te of ammonia.

Methodologies

Following the definition of release scenarios, quantification of the consequences has been carried out using recognised methodologies as noted below:

- Thermal radiation of pool fires and fireballs: Solid flame model and view factor method.

- Explosion overpressure: TNT Equivalent method.

- Dense gas dispersion: Austox (software developed by Monash University).

The analysis keeps the results conservative, which would tend to overstate the risks, based on the following assumptions:

- Thermal radiation level which will result in fatality: 12.5 kW/m² (normally this level is associated with a 50% probability).

- Explosion overpressure that will cause fatality: 0.35 bar (normally this level is associated with a 50% probability).

- Toxic dose of ammonia that would be lethal: 500 ppm. This was based on the time period of 30 minutes over which the toxic cloud would last in the most likely wind weather conditions.

- Toxic dose of chlorine that would be lethal: 50 ppm. This was done for the release of one 920 kg drum for comparison with the effects of ammonia.

The environmental impacts are commented on in terms of the likelihood of release of the contents of tankers.

23.5.1 Thermal Radiation Effects of a Spill of Oil Tanker

The spilt liquid would form a pool spreading on the road surface and would take a shape governed by road features like the camber, slope, drainage, etc. It is assumed that there would be a reasonably flat terrain and concrete surface so that a 40,000 L spill would form a pool equivalent to an area of a circle of 20 to 32 m diameter. If on fire this pool would emit thermal radiation that could injure people. A radiation level of 12.5 kW/m² would be felt by people at a distance of 23 m to 32 m from the centre of the pool depending on the size of the pool. We have generalised the effect distance to a radius of 35 m.

A pool fire of this size could last about 12 minutes if there were no drainage. In practice, some of the fuel could be lost in the drain and the fire could run out of fuel in a shorter time.

In the case of the more volatile products like petrol, there is a small chance that a flammable mixture of petrol vapour and air would form in the sewer. If ignition occurs after the flammable mixture has formed in the sewer, an explosion could occur. However, the chance of this scenario is extremely low.

Concrete noise barriers where provided would act as radiation shields.

23.5.2 Environmental Effects of an Oil Spill

Products of combustion of an oil spill would be carbon dioxide, water vapour, smoke and soot. These would generally rise up with the hot gases and disperse in the atmosphere. Products of combustion of petroleum are generally not regarded as environmental hazards at least in the sense of their immediate impacts on the local environment.

In the event there is no ignition, the spill would run on the kerbed area and into the stormwater sewer. The risk of pollution of water in the Hume Reservoir or the Murray River would depend on the location of the accident. The spill could gravitate towards the Hume Reservoir only if the accident occurs at the Bowna Creek Bridge at Bells Road where the relative elevation of the road is higher than the Hume Reservoir level. In other parts of all the three routes under consideration, the road surface is lower than the Hume Reservoir level, i.e., the risk of polluting the Hume Reservoir by spills in other parts of the road further south is nil.

Any spill on the causeway or the bridge on the Murray would fall directly into the river or the floodplain. This risk would be reduced by directing the drains on the bridges and the causeway to the banks into some form of containment for subsequent removal and disposal. The design of the proposed routes should allow for this control including the provision for rain water.

A spill on the existing Hume Highway route would end up in the Murray River where the existing stormwater sewer system is directed. This situation would apply even after completion of the inner or the outer route as petrol tankers would continue to serve the city's service stations.

23.5.3 Effects of LPG Release from a Bulk Tanker - Thermal Radiation of a Fireball

A sudden release of the full contents of a loaded tanker carrying 20 tonnes equivalent of propane and immediate ignition could result in a fireball. Assuming that 60% of the load contributes to the fireball, the fireball diameter would be 137 m and would last about ten seconds. The fire would continue until it is consumed. The fireball would cause a thermal radiation level of 12.5 kW/m^2 radiation and because of the short duration, the risk of this level of thermal radiation causing a fatality is very low. As a conservative measure, the full consequence distance of 306 m in the analysis has been applied.

23.5.4 Effects of LPG Release from a Bulk Tanker - Vapour Cloud Explosion

LPG will evaporate extremely rapidly in the first three minutes and then drop down to a very low rate in about eight minutes. Assuming typical wind speed of 3 m/s and stability E, the propane vapour cloud would disperse downwind as shown in Figures 7.2, 7.3 and 7.4 of Working Paper 9 which show the shape of the contour of the lower flammability limit of propane (2%). After a period of about six minutes the cloud disperses to harmlessly low concentrations. If a source of ignition is found within the first six minutes then a vapour cloud explosion could occur. The maximum distance to the lower flammability limit is found to be 280 m and a width of about 120 m. Explosion overpressure of 0.35 bar would be felt at a distance of about 102 m from the centre of the explosion. This equates to an area of 3.5 ha in the downwind direction of the accident.

23.5.5 Effects of a Release of Ammonia from a Bulk Tanker

The rate of emission of ammonia from a sudden release of 20 t equivalent of liquid is shown in Figure 7.5 of Working Paper 9. An initially rapid rate of evaporation drops to a negligibly low rate in about 40 minutes. Again assuming a wind speed of 3 m/s and E stability, the ammonia vapour and aerosol mixture will disperse down wind to concentrations of 500 ppm as shown in Figures 7.6, 7.7 and 7.8 of Working Paper 9. The maximum size of the cloud develops in about 30 minutes and then disappears to low concentrations rapidly. The maximum distance to this concentration is about 4,250 m with a cloud width of 500 m. This would affect people over an area of about 187.5 ha in the downwind direction of the accident. For comparison, the dispersion of chlorine to concentrations of 40, 50 and 60 ppm from the spill of a 920 kg drum, for the same wind speed and stability is shown in Figures 7.9 and 7.10 of Working Paper 9.

23.5.6 Effects on the Environment

In this risk assessment, environment is defined as the Murray River and floodplain and the Hume Reservoir. These areas could be damaged by any accidental spills of dangerous goods. In the areas away from these locations, environmental damage from spills would have local effects only. Products of combustion like carbon dioxide are not regarded as environmental pollutants for one-off incidents. Release of toxic gases is also not regarded as an environmental problem although they may affect small creatures and organisms that get exposure.

Quantification of environmental risks is presented as the likelihood of the incidents and the quantity of the spill.

23.6 Likelihood of Accidents

The likelihood of accidents and the ultimate consequences have been derived from a number of different sources. The inherent limitations of the statistics should be recognised.

The major conceptual difficulty in using historical accident data for quantification is the implicit assumption that the same rate of accidents would continue to apply. In fact, the road design incorporates significant improvements which should reduce the likelihood of accidents. It is also obvious that the type of accidents and their likelihood would be different on freeway conditions than on the existing urban roads.

23.6.1 Traffic Volume and Composition

Predicted annual accident rates for the high growth model for the year 2001 were used for the existing Hume Highway route segments. It was assumed that 15% of the vehicles would be commercial vehicles.

The road tankers involved in accidents were assumed to be loaded as a conservative measure although in practice there is a 50% chance that they would be empty or partially loaded.

23.6.2 Historical Accident Rates

RTA and VicRoads Data

Both RTA and VicRoads systematically collect road accident data and categorise the accidents according to the DCA. There are a number of limitations in the historical data:

- The proportion of accidents involving a release or spill of cargo or the type of cargo from trucks is not recorded.
- The cause of the accident is not recorded.
- The proportion of commercial vehicles that carry dangerous goods is not recorded. Similarly, the number of vehicles carrying dangerous goods in bulk is not known.
- The use of emergency services or whether they were called out is not recorded.

Wide variations are to be found in the average numbers or proportions developed from the historical data according to the area selected for analysis and the selected period over which the data is collected. Over time, roads have been improved and this shows in a reduction in the frequency of accidents. However, a few conclusions are obvious:

- The majority of accidents involve cars and occur at urban intersections both with and without traffic lights. Only about 10 to 20% of all the accidents involve trucks and semi-trailers.
- A large proportion of the accidents are minor accidents involving vehicle damage only. A large number occur at low speeds e.g., when parking or when leaving a parking spot or when entering an intersection.
- The proportion of accidents involving trucks and semi-trailers at intersections which involve the possibility of a collision to the side is about 23%; front end collisions is about 5%; rear end collision is about 21%.

- The proportion of accidents involving trucks and semi-trailers described as out of control and collide with roadside objects (e.g., a vehicle door, parked cars, sign posts, etc) is about 22% and most of these are at low speed; Running out of control at high speed (>80 km/h) is recorded for one particular part of the road only at Holbrook.

- The historical accident rate of urban roads is clearly not applicable to the highway road design.

The general averages derived from the historical data were used in the event trees applicable to the existing Hume Highway route.

Other Historical Data

The accident rate for heavy vehicles in NSW has been estimated at 1.5×10^{-6} per vehicle km (or 1.5 per million vehicle kilometres). This rate is similar to that derived by a range of studies. Based on an estimated distance travelled by LPG tankers, a rate of 9.8×10^{-8} per vehicle km (or 9.8 per 100 million vehicle kilometres) has been derived.

Studies acknowledge that the rates for LPG tankers are lower than other heavy vehicles. It is also acknowledged that the chance of a LPG tanker rupture is much less than that of a petrol tanker, as shown above.

The major problem with this type of data is that it does not relate to the type of roads over which the accidents are recorded.

23.6.3 Classes of Dangerous Goods

EPA Survey for NSW

A survey has been conducted by the EPA to estimate the relative volumes of different classes of dangerous goods that are being transported by road in NSW. The survey acknowledges the difficulties in collecting statistics and developing reliable set of data.

The break up indicated by the survey is:

□	Class 3	Flammable Liquids	79%
□	Class 2	Gases	10%
□	Class 8	Corrosives	5%
□	Class 6	Poisonous Substances	3%
□	Class 4	Flammable Solids	1%
□	Class 9	Miscellaneous	1%

The survey noted that data were not available to determine the relative proportions of transport in bulk and transport in packages.

Local Area Survey

Break up of the total volume per cent of difference classes of dangerous goods was based on a survey undertaken at Albury recently. The relative quantities of different classes were found to be significantly different to the NSW wide proportions:

□	Class 3	Flammable Liquids	55%
□	Class 2.1	Gases, Flammable	39%
□	Class 2.3	Gases, Poisonous	0
□	Class 5	Oxidising Substances	1%
□	Class 8	Corrosives	5%

23.6.4 Local Industry

The existing industrial activities in the Albury Wodonga area were reviewed to evaluate the likely usage of dangerous goods. It was found that the local industry consists of varied light industry with no single user of dangerous goods in bulk except for the Australian Newsprint Mills.

In Class 2.3 transportation of chlorine in bulk to or through Albury Wodonga is not a likely scenario. The local light industry, abattoirs, water treatment plants and swimming pools all receive their chlorine in 920 kg drums. The Australian Newsprint Mills plant does include a bulk ammonia storage tank.

The review indicated the following rates of usage of dangerous goods in the area:

Australian Newsprint Mills

Anhydrous ammonia (class 2.3): ten tankers per year from Sydney
Corrosives (class 8): 93 tankers from Sydney and Melbourne
Hydrogen peroxide (class 5): normally delivered by rail, partially by road - up to 80 per year from Sydney.

Service Stations

There are three distribution depots in Wodonga that receive products from Melbourne by rail. Two depots in Albury receive products by road from Melbourne. Expected tanker movements of road tankers have been developed from the locations of the depots and the volume of product movements.

LPG

LPG is supplied by road tankers from Melbourne directly to the service stations. The estimated number of tankers is based on the local area survey. Further, based on information supplied by one of the LPG companies, about 175 tankers supply LPG to the southern parts of NSW directly from Melbourne. This was assumed to be the level of through traffic of LPG.

Other Classes of Dangerous Goods

These were estimated from the local survey.

23.6.5 Prevailing Weather Conditions

Meteorological survey of the region indicates that the prevailing winds range from the south-east in January to north-west in July. Wind speeds range from 1 to 4 m/s in the mornings. In the afternoons winds are south-west throughout the year with speeds of up to 3 m/s.

On average, Albury has ten days of strong winds per year.

Annual frequency of fogs is about 16 days per year. These occur mainly in the months May to August. Fogs tend to persist in the valleys and hollows. Pockets of high fog may occur in winter months. Since fogs could be the cause of accidents, it is assumed that the road design incorporates adequate warning signs.

23.7 Risk Assessment

23.7.1 Risk to People

General

In accordance with the guidelines, risk is defined as the probable number of fatalities per year. Risk quantification of each alternative route is obtained by combining the estimated number of people exposed and the likelihood of the incidents for each segment of each route and a summation of the risk for the whole route. Risk from the existing Hume Highway route through the city was also evaluated as a base for comparison.

Inner Route

As the inner route is separated from the residential areas by, for most part (except for residences at East Albury and Corrys Hills), the effects of incidents from flammable liquids and LPG are likely to be nil. As a conservative assumption, an ammonia tanker accident has been included and is the only contributor to the risk from the route.

Outer Route

There are no densely populated residential areas near this route. The only population centre is Jindera with about 800 people which is located over 2 km away from the route. A number of small settlements near Sargeants Road, Hueske Road and Bungowannah Road are also found along the route, some as close as 150 m. The only risk contributor is the ammonia tanker incident, which has been included as a conservative assumption.

Existing Hume Highway Route Through the City

This risk estimation is based on the accident rates projected from the historical rates for the actual route. Residential areas are close to this route. Thus, the petrol and LPG incidents are likely to affect people more than in the case of the other routes. The number of people likely to be affected in the event of an incident would be higher and the existing route includes a larger number of likely accident spots. However, because of the lower vehicle speeds the likelihood of releases is somewhat lower.

Summary of the Risk to People

The individual risk to people associated with the existing route, the inner route and the outer route has been calculated as 8.75×10^{-2}, 5.29×10^{-3} and 5.50×10^{-4} respectively. Each of these levels of risk relate to an isolated assessment of the route under consideration. In order to provide meaningful comparison between the routes, they must be considered from an operational perspective, i.e., they must be considered in conjunction with the local road network.

The bulk dangerous goods carriers which contribute to risk have a large proportion with local destinations (around 54%) and fewer vehicles making through movements.

The existing route caters for vehicles making through movements as well as those with local destinations. The inner route also caters for vehicles making through movements as well as those with local destinations, but does so with a greatly reduced level of risk owing to the improved road conditions, e.g., restricted access, better horizontal alignment and removal of intersecting roads. The outer route would accommodate through vehicle movements, also with a greatly reduced level of risk owing to improved road conditions, but would not cater for traffic movements with a local destination. The majority of bulk dangerous goods carriers, as Chapter 5 shows, would continue to use the existing Hume highway with its associated higher level of risk than would occur with the use of the inner route.

23.7.2 Risk to the Environment

Risk to the environment has been defined as the chance of a spill of a load of oil or other chemical materials that could drain to either the Murray River and the floodplain or the Hume Reservoir from the Bowna Creek area. Results indicate that the environmental risks are extremely low (see Working Paper 9 for further details). Further, there are practical measures that can be adopted to reduce the risks even lower by providing drainage from the river crossings to purpose designed containment tanks on the banks of the river.

23.8 Safeguards

Recommendations arising from the risk assessment which have been adopted by the proponents for this project and which can be dealt with by the road authorities are that further risk reduction may be achieved by the following measures:

- In order to prevent any spills from falling into the Murray River, the surface drainage on the river crossings should be directed to containment tanks on the banks of the river. The same comment applies to the Bowna Creek bridge. Similar approaches should be applied to locations where the route is close to a farm dam.
- Warning signs for adverse conditions ahead, for example fog, should be provided, if not already considered.
- The road design of the selected route option, when complete, should be independently reviewed to check that adequate risk reduction measures (such as spill control, emergency access, water supplies, etc) have been incorporated in the design.

Further recommendations which are not the direct responsibility of the road authorities but which would be drawn to the attention of other relevant authorities are:

- The existing stormwater drainage system in the city is directed to the Murray River. The risk of pollution from spills via the stormwater system should be reviewed by the respective councils.
- The existing controls on the transportation of radioactive materials, infectious substances and explosives should be reviewed and consideration should be given to restricting other traffic on the Murray River crossing when explosives are being transported over it.

One further recommendation of a general nature arises from the study. It is related to the issues covered in the study but was not specifically part of the objectives and scope of the study. The recommendation would assist in future risk assessments and improvements in road design:

- Statistical data collected by the relevant authorities such as the Police, EPA and other authorities should be enhanced to include a record of:
    - the vehicle type and the class of dangerous goods involved in an accident and whether any spill occurred;
    - whether emergency services were called out;
    - reference to any detailed investigation into the cause of the accident;
    - the nature and type of damage; etc.

Indeed, there is a need for developing a comprehensive, relevant and standardised format and database covering the accidents and the results of accident investigations. Such a data base should be in a standard format for Australia-wide use.

23.9 Conclusions

The transportation risk assessment provides a systematic evaluation of the consequences and likelihood of the worst than can happen in the transportation of dangerous goods on the two highway options and whether that poses a risk to the residents. Transportation risk is defined as the probable number of fatalities to the local people from accidents on the road involving vehicles carrying dangerous goods in bulk. Risks to the people involved in the accident and other road users involved in the accident are not included in the definition in this type of analysis. Quantification of risks related to the transportation of dangerous goods provides a basis for comparison between options. The quantified results must not be taken to be absolute as the data are subject to qualifications. For this reason, quantification is based on conservative assumptions that tend to overstate the risk rather than understate it.

The definition of risk and the methodology employed gives a risk profile of each route option stated as the probable number of fatalities per year. In this format, the calculated risks are not comparable to the everyday risks like smoking and flying that the exposed individuals face and accept.

In summary, the conclusions are:

- Both the options offer significant risk reduction over the existing Hume Highway route. The risk reduction is related primarily to the freeway type road design which reduces the likelihood of accidents owing to the well separated carriageways and a limited number of intersections with appropriately designed entries and exits.

- The calculated risk associated with the outer route by itself is lower because of the lower volume of through traffic of dangerous goods and because of the low level of population adjacent to it. However, when considered as part of the whole system, it does not offer a risk reduction better than the inner route because the dangerous goods traffic with local origin/destination would continue to use the existing road network in a population greater than that adjacent to the inner route.

- Since risk is a combination of both the consequence and the likelihood, and both the inner and outer route designs reduce the likelihood of accidents by design, any further opportunity for risk reduction must consider the control of consequences of an accident. These include, for example, the design of drainage and spill control on all types of terrain whether flat or hilly (to prevent the formation of pools and to prevent runoff to dams and rivers), communications with emergency services, design of access for the emergency services, availability of water for wash down and fire fighting, etc. Other opportunities for risk reduction are: training, attitude and behaviour of all road users particularly the drivers of the vehicles carrying dangerous goods in bulk, which is subject to regulations; maintenance and upkeep of the vehicles carrying dangerous goods, which is subject to regulations; policing of the driver behaviour; and policing of compliance with the regulations. These issues are beyond the scope of this study.

- By far the largest population of the dangerous goods transported in the area are petroleum products and LPG. Risks associated with their transportation on the existing route and the existing urban road network would remain as neither of the two options would eliminate the need to supply the service stations. This need to maintain supplies to the service stations means that the inner route would attract a larger proportion of the petrol and LPG tankers than the outer route. A large proportion of the tanker traffic would continue to use the existing route and the urban road network.

- Risks from petroleum products is characterised by relatively smaller effect distance but higher likelihood because of the more frequent movements. Risks associated with the transportation of toxic gases are low because although the effect areas are high, the likelihood is extremely low. Risks associated with transportation of corrosives and other substances are not likely to affect people and they represent a risk to the environment.

- Risk of environmental pollution is low in both the options, the sensitive area being the Murray River crossing and the floodplain. This risk may be reduced further still by designing appropriate drainage on the crossing.

- It has been observed that the existing stormwater system in the city poses an environmental risk as it discharges directly to the Murray River. Assessment of environmental pollution risk associated with the existing stormwater system is beyond the scope of this study. However, this report recommends that the risk of pollution from spills via the stormwater should be reviewed by the respective councils.

- The classes of dangerous goods covering explosives, radioactive substances and infectious substances are excluded from the study because they are subject to special controls and legislation that is considered to be beyond the scope of a risk assessment of this type. This report recommends that the existing controls on their transportation be reviewed and consideration be given to restricting normal traffic on the causeway when explosives are being transported over it.

- Currently, accident statistics are being collected by various authorities in differing formats and for different purposes, for example, the police, road and traffic authorities and the EPA. Variations are to be found in the format and classification of accidents between states. Available accident statistics do not record the cause of the accident. Currently, there are no data available on the volumes and classes of dangerous goods in transportation. Similarly, statistical format of the road accident data does not require noting down whether any dangerous goods were involved in the accident or whether the emergency services were called out. This places limitations on any attempt at quantification.

Chapter 24
Cumulative Impacts

This chapter assesses the cumulative impacts of the project (both route options) as required under Clause 82(2)(o) of the NSW Environmental Planning and Assessment Regulation, 1994. Issues addressed include transport efficiency, road safety, and socio-economic and environmental impacts.

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CHAPTER 24

CUMULATIVE IMPACTS

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24 CUMULATIVE IMPACTS

Cumulative impacts may result from a number of different elements within a project as well as from a number of different projects with interacting impacts in the same locality. The impact of each element of the project combines to form the cumulative impacts of the project. The impact of individual projects such as this one when considered in light of other projects within a locality also must be assessed.

This chapter deals with both these forms of cumulative impacts by summarising all the identified impacts for this project as set out in this EIS/EES, in total rather than separately or in isolation. This 'total impact' of the project is then considered in conjunction with other projects in the area. Table 6.3 in Chapter 6 summarises each of the items listed in Clause 82 of the Regulation of the NSW EP&A Act, and indicates where those items are discussed in this document.

24.1 Nett Impacts

In the economic evaluation in Chapter 10, impacts of the routes are translated into benefits and costs. Those benefits and costs which could be quantified are given a monetary value. Economic evaluation is therefore one method of assessing the cumulative impacts of all factors. One limitation of economic evaluations is that not all factors can be quantified. However, in the economic evaluation of this project, most of the key factors were quantified wherever possible, enabling a good indication of cumulative impact.

To complement the quantitative economic evaluation, the cumulative impact of all factors is shown in Tables 24.1 and 24.2. The tables provide a short description of the impact of all factors, both positive and negative. The cumulative impacts for the inner route are shown in Table 24.1 and the cumulative impacts for the outer route are shown in Table 24.2.

Table 24.1 -- Cumulative Impacts for the Inner Route

Evaluation Criterion and Factor	Impact Assessment
Transport Efficiency	
Capacity of Transport System	Improved capacity because of grade separated interchanges and limited access to local road system. High capacity with grade separation. Existing network efficiency increased as current load is taken off existing roads. Provides capacity to cater for traffic growth in the existing and proposed release areas around Albury Wodonga.
Public Transport	Would provide good access to proposed bus-rail interchange at Albury Rail Station. Tour coaches would benefit from using the route as it would be congestion free, particularly during peak holiday periods.

(Table continued over)

Table 24.1 -- Continued

Evaluation Criterion and Factor	Impact Assessment
Transport Efficiency Cont'd	
Travel Time	Travel time and operating cost savings for public and private commuters. Savings predominantly on route but local traffic would also benefit because of the diversion of traffic. Cyclists would benefit from the provision of a dedicated cycleway.
Road Safety	
Road Accidents	Fewer road accidents because of better traffic flow and less traffic conflict points. Reduced risk to pedestrians and cyclists on local streets because of traffic diversion.
Risk from Transport of Materials	Lower risk because link is safer than existing roads.
Rail Crossings	Elimination of four existing level crossings.
Social and Economic	
Community Severance	Localised community severance, particularly East Albury. Some 'rat runs' now dividing communities would have reduced effect.
Visual Impact	Significant visual impact because of ramps, and interchanges, particularly in short term. Opportunities for visual improvements and redevelopment of adjacent properties with more suitable urban form.
Property	Severance of rural properties along northern part of route. No severance of urban properties.
Traffic on Local Streets	Reduction in through traffic on local streets. Opportunities for traffic calming on some streets.
Economic	At 7% discount rate, the construction cost $203 million; benefit cost ratio 2.21.
Environmental	
Noise	No residences exposed to 'clearly unacceptable' operational noise levels following implementation of noise amelioration measures. Reduced impact on many residences adjoining roads now carrying major traffic as traffic diverts to the new link. 286 residences, Scots School, a caravan park and kindergarten affected by construction noise under target 1 criteria. No buildings affected by construction noise under target 2 criteria.
Air Quality	No impact on regional air quality and minimal impact on local environment.
Erosion	Potential effect because of earthworks and excavations.

(Table continued over)

Table 24.1 -- Continued

Evaluation Criterion and Factor	Impact Assessment
Environmental Cont'd	
Sedimentation and Water Quality	Potential impacts on Murray River catchment. Opportunity for mitigation.
Energy Conservation	Considerable fuel savings.
Impacts on Utilities and Services	Not a major effect.
Flora and Fauna	No FIS required. No endangered species recorded. Some locally or regionally rare flora. No significant reduction in fauna habitat. Potential disturbance to movement corridor along Murray River. Planting program could supplement resources. Potential impact on Parkland.
Archaeology	Three isolated finds, three open campsites and two areas of archaeological potential would be affected.
Heritage	Eleven items of varying significance are affected, although their historic integrity is not jeopardised.

Table 24.2 -- Cumulative Impacts for the Outer Route

Evaluation Criterion and Factor	Impact Assessment
Transport Efficiency	
Capacity of Transport System	Improved capacity because of grade separated interchanges and limited access to local road system. High capacity with grade separation. Existing network efficiency improved as current load is lowered. Provides capacity to cater for traffic growth in the Jindera area.
Public Transport	Tour coaches would benefit from using the route as it would be congestion free, particularly during peak holiday periods.
Travel Time	Travel time savings for public and private commuters not stopping in Albury or Wodonga. Travel time savings predominantly on route but local traffic would also benefit because of the diversion of some traffic.
Road Safety	
Road Accidents	Fewer road accidents because of better traffic flow and less traffic conflict points. Reduced risk to pedestrians and cyclists on local streets because of traffic diversion.
Risk from Transport of Materials	Lower risk because proposed link is safer than existing roads.
Rail Crossings	No Change

(Table continued over)

Table 24.2 -- Continued

Evaluation Criterion and Factor	Impact Assessment
Social and Economic	
Community Severance	Localised community severance, particularly east and west of Jindera
Visual Impact	Significant visual impact because of ramps, interchanges, major excavations and new road in rural area. Opportunities for visual improvements and redevelopment of adjacent properties with more suitable urban form.
Property	Severance of rural properties along length of route. No affect on urban areas.
Traffic on Local Streets	Little change in traffic on Albury Wodonga roads
Economic	At 7% discount rate, construction cost $263 million; benefit cost ratio 1.01 (dual carriageway). At 7% discount rate, construction cost $189 million; benefit cost ratio 1.40 (single carriageway).
Environmental	
Noise	No residences exposed to 'clearly unacceptable' operational noise levels following implementation of noise amelioration measures. Reduced impact on some residences adjoining roads now carrying through traffic. 3 residences affected by construction noise under target 1 criteria. No buildings affected by construction noise under target 2 criteria.
Air Quality	No impact on regional air quality and minimal impact on local environment.
Erosion	Potential effect because of earthworks and excavations in areas of highly erodable soils.
Sedimentation and Water Quality	Potential impacts on Murray River catchment. Opportunity for mitigation.
Energy Conservation	Fuel savings.
Impacts on Utilities and Services	Not a major effect.
Flora and Fauna	No FIS required. One endangered species recorded. Some locally or regionally rare flora. No significant reduction in fauna habitat. Potential disturbance to movement corridor along Murray River. Planting program could supplement resources.
Archaeology	Two isolated finds, seven open camp sites and five areas of archaeological potential would be effected.
Heritage	Four items of varying significance are affected although their historic integrity is not jeopardised.

The economic evaluation in Chapter 10 found that the benefits of both the inner route and the outer route would be greater than the costs.

As shown in Tables 24.1 and 24.2, the major adverse impacts of the proposed routes would be noise, impact on property and visual quality. The major impacts would tend to be localised on residents and communities on either side of the routes.

24.2 Cumulative Impact with other Projects

Assessment of the cumulative impacts of some of the issues relating to the project has been undertaken in Part D of this EIS/EES. Noise impact has, for example, been assessed based on existing background noise levels, including contributions from surrounding land uses and the potential cumulative noise impacts resulting from traffic growth. Traffic volumes currently operating on the road system have been modelled for future growth and the cumulative impact of traffic levels resulting from future development growth projections forms part of the assessment.

The Albury Wodonga National Highway project represents the most significant transportation project in the region. Additional major transport related projects include the development of a bus interchange at Albury Station, upgrading of Albury Airport and a proposed upgraded rail corridor through the study area. Other major projects proposed for the region include:

- quarry development
- expansion of the university
- upgrading of ANM mill
- upgrade of sewage treatment plant.

Cumulative impacts could include issues such as materials shortages, demand on short-term accommodation and short-term demand for services and facilities.

Discussions with the local councils have confirmed that no further major projects are currently being assessed.

Detailed environmental impact assessments of those other projects have not yet been undertaken. In general terms, however, there would be pluses and minuses associated with these projects.

Development of a bus interchange at Albury Station may result in minor increases in bus movements or localised car movements if patronage increases as a result of this facility. Such increase, if any, would be of a minor nature and would not adversely change any of the impacts dealt with in this EIS/EES. It should be noted that if the development of a bus interchange proceeds, construction of the outer route would not provide any cumulative benefits in terms of road access to the new facility. Conversely, construction of the inner route would, because of its proximity to the proposed interchange, provide greater opportunities in terms of vehicular access and would therefore generate cumulative benefits.

Upgrading of Albury Airport would not cause any perceptible change in the impacts of the proposed National Highway route. Higher patronage and servicing requirements would result in increases in traffic concentrations but such changes would be of a limited nature only. Some opportunities exist for the upgrading of the airport to complement construction of the inner route. Utilisation of Airport Hill as an external source of fill material for the inner route would be beneficial in terms of the airport upgrading and the proximity of the airport to the inner route and the Borella Road interchange would also be beneficial. Construction of the outer route would have little or no cumulative benefits or adverse impacts in respect of the airport upgrading.

Development of an upgraded rail corridor through the study area would not have a cumulative impact with regard to construction of the outer route. If additional rail movements occur as a result of the proposal, it is possible that there would be some cumulation of noise impacts in conjunction with the construction of the inner route. Without knowledge of likely timetables or full details of the rail corridor project, which are not yet available, it is not possible to quantify impacts from that proposal nor the cumulative effect if any. It would, however, be the responsibility of the proponents of the rail corridor project to ensure their project did not create unacceptable adverse impacts. Concept design investigations by the RTA and VicRoads reveal that it would be possible to accommodate a rail link in this location without relocation of the proposed main road carriageways by relocating the Freeway offloading ramp closer to the through carriageways.

24.3 Conclusion

The major adverse cumulative impacts of the proposed routes, as shown in Tables 24.1 and 24.2 would be noise, property impacts and visual quality. The tables also show the major beneficial cumulative impacts of the proposed routes would be in respect of road safety and access, local amenity and energy conservation.

There would be little cumulative impact with other projects, with the exception of issues such as materials shortages, demand on short term accommodation and short term demand for services and facilities. Upgrading of Albury Airport would provide opportunities for earthworks associated with that project and construction of the inner route to complement one another.

PART F
VALUE MANAGEMENT

Chapter 25
Value Management Study

The Value Management Study is contained in Working Paper 11.

The Value Management Study was commissioned by the Working Party to examine objectively both the inner route and the outer route options with a view to establishing the best value for money solution for each option. Further, it was conducted to review generally the options so that all necessary functions could be provided at the lowest total cost consistent with the required levels of quality and performance.

DOCUMENT LAYOUT

25 VALUE MANAGEMENT STUDY

Public Works' Product Evaluation Unit (PEU) was commissioned to undertake the Value Management Study (VMS) for the project by the working party which is coordinating the investigations for the National Highway in the Albury Wodonga region. A key element of the VMS structure is the concentrated workshop sessions attended by the key stakeholders of the project. These were held on the 8, 9 and 10 November, 1994.

This chapter incorporates the report compiled by the PEU. It provides an objective overview of project aspects and value management outcomes up to the formulation of an action plan.

The action plan provided the basis for further action and investigation to be completed before the EIS/EES process was concluded.

25.1 General

General Aim

In broad terms, the aim of the Value Management Study is to provide all the necessary functions required of the project at the lowest total cost, consistent with the required levels of quality and performance.

Specific Study Activities

The following activities were noted for consideration within the workshop:

- Identify the project objectives.
- Review the outer route option to ensure all necessary functions are provided and optimise the scope of works.
- Review the inner route option to ensure all necessary functions are provided and optimise the scope of works.
- Identify opportunities for value improvement on both routes.
- Identify any further environmental investigations which may be required as part of the EIS/EES.
- Canvass and address key issues and concerns of the major stakeholders.
- Develop an Action Plan to progress the project.
- Clarify planning horizon implications on the options.

Value Study Group

The Value Study Group (VSG) included representatives from:

- Roads and Traffic Authority
- VicRoads
- Federal Department of Transport
- Albury Wodonga Development Corporation
- Commonwealth Environment Protection Agency
- NSW Environment Protection Authority
- Hume Council
- Albury Council
- Rural City of Wodonga
- NSW Police Service
- various road development and environmental consultants.

25.2 Project Overview

In order to allow all participants to gain an understanding of the planning and philosophy of the project to date, a number of brief overviews were presented on its salient aspects. This provided a platform for informed questioning and later generation of ideas for improvement.

The perspectives of the RTA, VicRoads, the Federal Department of Transport and the relevant councils were outlined. In addition, the initial findings on the environmental studies were presented to the Value Study Group by GHD. At this point, a 'problem situation' was developed, as were project givens and assumptions. A full list of these matters can be found in Working Paper 11.

25.3 Project Analysis

After considering the information presented, the VSG analysed the project functions and looked for value improvements.

25.3.1 Overview

At the very core of the value management process is the analysis of function, i.e., what the system, project, or task must do, what are the cost implications and what are the alternatives.

Through the analysis of function, it is possible to identify duplication, unnecessary expenditure and possible wastage and thus provide the opportunity for value to be improved. The function analysis perspective not only enables value management to explore the requirements of the project and/or the project brief but also to test the assumptions and needs perceived by the authors for the brief.

25.3.2 Function Analysis

With the benefit of having defined 'Project Assumptions' and earlier the 'Problem Situation', the function analysis for the project was handled in three ways.

The first was for the VSG to list the functions of the road as either generic functions or those that related to either the inner route option or the outer route option.

Secondly, the VSG developed a function diagram for the project (see Table 25.1) to obtain a better understanding of the functions for the road from a 'whole of system' perspective. The VSG listed functions and later amended, added to and endorsed the layout presented to them as a representation of the functions of the proposed road system. The function diagram allowed the VSG to understand quickly the project functions and determine the purpose of each function.

The VSG determined higher level (first order) functions (i.e., functions underlying the reasons for the existence of the project) and then identified second and third order functions (i.e., how these higher order functions can be achieved).

Table 25.1 -- Function Diagram of the National Highway Routes, Albury Wodonga

1st Order Function	2nd Order Function	3rd Order Function
Social and Economic Objectives	Carry traffic □ Inner Route (cost $212 m) □ Outer Route 4 lane (cost $310 m) □ Outer Route 2 lane (cost $230 m)	Provide route (Inner Route cost $180 m) Cross river (Inner Route cost $32 m) Provide trafficable surface.
Transport people, goods and services (in a safe, environmentally acceptable manner).	Regulate traffic □ Inner Route (cost $26 m) □ Outer Route 4 lane (cost $36 m) □ Outer Route 2 lane (cost $36 m) Manage environment □ Inner Route (cost $6 m) □ Outer Route 4 lane (cost $6 m) □ Outer Route 2 lane (cost $6 m)	Provide access Separate traffic Manage safety Minimise noise impact Minimise visual impact Minimise air quality impact Convey flood water Facilitate revegetation Minimise soil/sedimentation impact Protect flora/fauna Manage bushfire impact

Note:($)Indicative cost of each option identified by the Value Study Group. These were the amounts calculated in a preliminary study and available to the VSG. They have been subsequently revised and reviewed and used in other parts of this document.

The VSG identified points of leverage (i.e., functions which were focussed on as pareto items in terms of cost or economic benefit). These were identified with cost amounts for each option against particular functions in Table 25.1.

By undertaking this exercise, the VSG identified why each function was necessary and would later speculate on alternative ways to undertake those functions or in the case of undesirable functions, ways of eliminating or minimising them.

Thirdly, based on the presented information and defined road functions, a sub-group was requested to clarify the project objectives for discussion by the Value Study Group as a whole. The VSG endorsed the project objectives as being:

To provide a road through the Albury Wodonga region as part of the Sydney to Melbourne National Highway Route which:

- best meets National Highway objectives by:
  - providing consistent traffic conditions along the highway;
  - reducing total travel costs and travel time;
  - improving road safety;
  - providing limited access;
  - facilitating regional trade, commerce and tourism;
  - achieving a cost effective solution;
  - accommodating medium term needs;
  - providing the scope to accommodate long-term needs;
  - addressing short-term issues where practicable.
- improves upon the existing road and traffic conditions;
- minimises adverse impacts upon the community and the environment;
- complements urban development objectives;
- improves the linkages between Albury and Wodonga as well as NSW and Victoria;
- safeguards and enhances where possible environmental amenity in accordance with ecologically sustainable development principles;
- creates the opportunity to improve regional amenity.

After the completion for the Workshop, the DoT tabled the National Highway objectives as being: 'to maximise benefits to the public by maintaining and developing a network of connecting roads (known as the National Highway System) which:

- ***facilitates overseas and interstate trade and commerce;***
- ***is safe to use;***
- ***allows reliable access by non-urban residents to major population centres, particularly where there are limited other transport opportunities; and***
- ***contributes to ecologically sustainable development.'***

The discussions by the VSG in establishing project objectives and functions, and their importance and cost significance, raised issues about the project which were used in the speculative phase of the workshop and are elaborated further in Section 25.4.3.

Having focused clearly on the characteristics of the project and their impacts, the VSG was in a position to generate ideas for improvement.

25.4 Project Improvement Options

25.4.1 Methodology

Sections 25.2 and 25.3 summarise the outcomes of the first two stages of the Value Management 'Job Plan', i.e., the information and analysis phase. These phases provided the platform for the generation of ideas/options for improving project value.

The ideas generated resulted from asking the following questions with respect to the areas under investigation.

Can We....?

- Simplify anything?
- Eliminate anything?
- Combine anything?
- Relocate anything?
- Change anything?
- Add anything?

During the information and analysis phases, the VSG was already questioning assumptions and formulating ideas and improvements for the project which were recorded individually at that stage. Subsequently during this more formal speculative phase of the workshop, some of these issues were revised, further elaborated and reinforced.

The generation of ideas was undertaken in five sub-groups to ensure a full coverage of salient aspects of the project and to maximise the range of ideas. Participants were asked to generate as many ideas as possible and to defer judgement of ideas until later in the Workshop. The sub-group categories were:

- Inner Route Optimisation
- Outer Route Optimisation
- Community Liaison and Information Issues
- Environmental Management Issues
- Whole of system 'Big Picture' Issues.

25.4.2 Ideas Generated

Overall, 188 ideas/questions were guaranteed by the sub-groups and then a further six ideas/questions were created by the VSG as a whole. An assessment of the ideas was then carried out.

Given the workshop session was of limited duration, the discussion of each of the ideas was assessed by the VSG as a:

- Realistic Possibility, P1 - the idea has merit and identified as worthy of further evaluation during the workshop. The idea can be developed or combined with other ideas to develop an action or theme to progress the project.

- Remote Possibility, P2 - the idea has some merit however remote and should be considered if appropriate outside the workshop.

- Discard, D - there is no benefit in further pursuing the idea and rejection of the idea is concurred by the VSG or the idea is considered outside the scope of the study.

- Previously Addressed - the idea has been previously raised and assessed by the Value Study Group.

25.4.3 Theme Development

As a result of the evaluation of ideas and other matters raised during the function analysis phase of the workshop, sub-groups were again formed to develop particular themes/options in order to build on the improvements identified to date.

Each sub-group presented its work to the whole group for discussion.

Inner Route Improvements

This sub-group considered the ideas assessed by the whole group as worthy of further investigation for potential improvements to the inner route and developed the ideas into alternatives/variations to the current concept. The sub-group presented its findings to the group as recorded in Working Paper 11. A summary of potential value improvements endorsed by the group for further evaluation through the action plan included:

- Evaluate shortening the route by bridging across a narrow section of Lake Hume.

- Consider relocating the route to more closely follow the existing highway between Thurgoona Road and Ettamogah (near Billy Hughes Bridge).
- Consider modifying the present concept to provide southbound ramps from the inner route to the existing highway at Billy Hughes Bridge in lieu of north facing ramps at the Williams Road interchange.
- Consider relocating the corridor closer to the railway where feasible to potentially free up an area for other landuses, but only if this does not compromise long term traffic capacity requirements of the route.
- Evaluate the provision of a half diamond interchange (i.e., south facing ramps) at Bridge Street with a single underpass.
- Consider a median width from Thurgoona Street southwards to allow for future expansion to six lanes (and a residual median which provides potential for eight lanes if required in the long term).
- Consider designing the bridge over the Murray River to allow for a potential infill structure for future extra lane options.
- Consider staging options to improve the economic performance of the project (i.e., consider construction of the southern end of the project initially) and thus potentially increase the priority for Federal Government funding.

Outer Route Improvements

This sub-group considered the ideas assessed by the whole VSG as worthy of further investigation for potential improvements to the outer route option and developed the ideas into alternatives/variations to the current concept.

A summary of potential value improvements endorsed by the VSG for further evaluation through the action plan included:

- Review each of the proposed flyover structures particularly where they are in close proximity and rationalise access patterns (i.e., consider Hueske Road and Table Top/Funks/Molkentin Roads).
- Review each grade separation structure with respect to traffic volumes and consider at-grade intersection alternatives (for medium or long term scenarios).
- Review the route alignment south of the Murray River.
- Consider the reduction of the bridge structure at Moorangury by reviewing the grades near the proposed dam site.

- Investigate the economic advantages of initial lower cost flexible pavement with medium and long term strengthening overlays.

- Liaise with the appropriate authority to discuss the navigation clearance requirements for the new bridge on the Murray River in particular the construction, visual and cost implications.

Improvements to Both Routes

As a result of the discussion and presentations in Section 25.4.3, the VSG agreed the following potential improvements relating to both options should be referred to the action plan for further evaluation. In particular:

- Consider the treatment of the common section of road between Sweetwater Road and Bells Road as a separate project or possibly a separate stage.

- Consider the affectation to stock reserves generally but in particular the need to re-establish the reserve near Sweetwater Road.

- Consider pavement material selection options (asphalt versus concrete).

- Review/refine the cost estimates for each option.

- Investigate grade variations during detail design to reduce earthworks.

- Ensure emergency access is available to and through the routes for emergency vehicles.

- Ensure emergency services are available for roadusers (i.e., emergency phones).

- Consider the potential for savings in time and roaduser costs arising from a more direct route between Bowna Creek and Holbrook before making a major investment at the northern end of both routes.

The VSG acknowledged that a substantial amount of community consultation had already taken place on the project and an expectation existed within the community that the current concept for each route was reasonably fixed.

Therefore, any consideration of potential value improvements to the inner and outer route options will not only need to be assessed on technical and economic grounds but include consideration of environmental and social equity impacts. Should potential value improvement opportunities warrant a change to the current concepts, community consultation of the proposed refinements will be undertaken before they are finalised or adopted.

Community Liaison Strategy

This sub-group outlined a potential community liaison and information strategy for implementation, if appropriate to cover the pre-exhibition, exhibition and assessment periods. The sub-group's strategy is outlined in Working Paper 11 and was referred to the action plan for evaluation by the working party.

It was noted that the first period (i.e., pre-exhibition period) was part of the GHD consultancy for the EIS/EES process. The exhibited period again is part of the EIS/EES process which requires comment from interested parties. During the assessment period, the community liaison strategy would be mainly by telephone contact and static display. The only new information which could be disseminated at that stage would be about the process of assessment since no time frame for decision making has been made.

Environmental Management Issues

This sub-group examined the ideas previously assessed and developed an Environmental Management Plan for consideration by the Group. The sub-group's presentation outlined their concerns about the project from an environmental perspective and suggested the project should be constructed and operated in accordance with ecologically sustainable principles being:

- intergenerational equity;
- conservation of biological diversity and ecological integrity;
- improved valuation and pricing of environmental resources.

The sub-group outlined and elaborated on the components of an Environmental Management Plan (EMP) for the project being:

- landscape/visual components
- noise impact
- drainage/erosion impact
- fauna management
- monitoring/audits (i.e., ongoing management).

Further, the sub-group articulated how the EMP relates to the project. In summary, this was viewed as:

- The principles of the EMP should be produced as part of the EIS/EES.

- The EMP should outline the safeguards required to be designed into the project and written into the construction contract and appropriately costed.

- The EMP principles should continue during and post construction by auditing and environmental monitoring.

Finally, the sub-group identified other investigations to be carried out on the project including the undertaking of baseline monitoring of water quality, dust and noise data for ongoing comparative studies.

As a result of the presentation, the VSG agreed that the project should be constructed and operated in accordance with ecologically sustainable development principles and that principles of an EMP should be produced as part of the EIS/EES process. The group also requested (as part of the action plan) a cost estimate be prepared to develop and implement an EMP.

Briefing Notes for the EIS/EES

This sub-group discussed a number of issues relating to the 'whole of system' perspective of the project. As a result, the group endorsed a number of actions/briefing notes to be addressed in the action plan. The presentation raised a number of interesting issues including:

- integrating the road with regional development (i.e., how does the project, the preferred route(s), enhance regional development and how does regional development influence the road?).
- what benefits the inner and/or outer routes generate in these contexts.
- National Highway functions (i.e., how does the project cater for through traffic and traffic into/out of the region).
- What is the 'value' of the project in meeting the National Highway objectives and how does each route meet them.
- There is a need for close liaison between the implementing agency and the regional authorities.
- Integration of the road into the local context.
    - Promote the project to ensure the local/regional planning processes will:
        - Control access.
        - Promote compatible adjacent landuses.
        - Utilise/maximise development opportunities.
- Funding sources
    - Will Federal funding be available for construction of either route? This is dependent on whether the route(s) are declared as part of the National Highway system, and the priority of the project by the Federal Government.

- ♦ There may be a need to investigate funding from other sources (i.e., regional development funds from Federal/State/local sources).

□ Alternative staging scenarios

- ♦ Are there combinations of options that maximise returns and can these be Federally funded?
- ♦ There is a need to test variations taking into account traffic and regional development benefits, timing and staging towards a long term solution.

□ Intermodal Issues

- ♦ There is a need to address whether the project can be deferred by increasing rail freight, bus and cyclist movements between Albury and Wodonga.
- ♦ How does each route best service future rail/road freight and passenger interchanges at Albury Station.

□ Government Issues

- ♦ There is a need to integrate Federal/State/local objectives and demonstrate whether they can be met by the route(s) in the medium and long term and demonstrate the benefits of so doing.
- ♦ There is a need to investigate that if the inner route is constructed whether the outer route can be reserved for the long-term on social and economic grounds.

As a result of the discussion, the Group:

□ Acknowledged the processes and the minimum time frame involved before a preferred route(s) could be determined. However, the participants recognised the need for a decision to be made as soon as possible.

□ Agreed that if the outer route is declared part of the National Highway system, a substantial sum of money would still be required to alleviate regional traffic problems in Albury Wodonga.

□ Requested that staging variations of elements of the inner and outer routes be tested including combinations of both (i.e., the outer route option with a duplicated bridge near the Lincoln Causeway).

□ Requested that the ways in which the inner route option and the outer route option support and are compatible with the existing road hierarchy be reviewed to ensure an efficient and integrated network.

25.4.4 Workshop Outcomes and Decision

As the final output of the workshop, an action plan was formulated which identified matters needing to be resolved and pursued to enable the project to be further developed. Additionally, issues raised and discussed during the workshop led to the following decisions and workshop outcomes.

As a result of the workshop, the participants:

- Confirmed the project objectives.
- Acknowledged the processes and the minimum timeframe involved before a preferred route(s) could be determined. However, the participants recognised the need for a decision to be made as soon as possible.
- Agreed that if the outer route is declared part of the National Highway system, a substantial sum of money would still be required to alleviate regional traffic problems in Albury Wodonga.
- Reviewed the outer route option and recommended the evaluation of potential value improvement opportunities as identified in the workshop and outlined in the action plan.
- Reviewed the inner route option and recommended the evaluation of potential value improvement opportunities as identified in the workshop and outlined in the action plan.
- Recommended the evaluation of potential value improvement opportunities common to both routes as identified in the workshop and outlined in the action plan.
- Highlighted that of all potential value improvements to the inner and outer route options need to be assessed not only on technical and economic grounds but also on environmental and social equity impacts. Should potential value improvement opportunities warrant a change to the current concepts, community consultation on the proposed refinements will be undertaken.
- Outlined a potential community liaison and information strategy to cover the pre-exhibition, exhibition and assessment periods for implementation if appropriate.
- Outlined an EMP for consideration. The participants agreed the project should be constructed and operated in accordance with ecologically sustainable development principles. The principles of an EMP should be produced as part of the EIS/EES process.
- Identified as part of the EIS/EES process further investigations required to:
    - Undertake baseline monitoring of water quality, dust and noise data for ongoing comparative studies.

- ♦ Outline the principles of an EMP for the project.

- □ Listed a number of briefing notes to be considered in the EES/EIS document as set out in the action plan.

25.5 Action Plan

The action plan represents the final consolidation of the structured workshop activity. The investment return flowing from the workshop is greatly dependent on the vigour with which the action plan tasks are pursued.

It should be noted that the action plan consists of items which were specifically tabled at the end of the third day of the workshop. Also, the plan is supplemented by actions as a result of the questions generated during the speculative phase of the workshop.

Some of the actions on the list are already in hand. However, to ensure an appropriate level of resource is applied to the tasks, Mr Tony Dobbin, Project Manager, RTA, was suggested as the Action Plan Coordinator (APC). Tasks to be undertaken by the APC are shown in Table 25.2.

Table 25.2 -- Action Plan Tasks

No.	Task
1	Evaluate potential improvement opportunities to the various options as identified in the workshop. In particular: **Outer Route** □ Review each of the proposed flyover structures particularly where they are in close proximity and rationalise access patterns (i.e., consider Hueske Road and Table Top/Funks/Molkentin Roads). □ Review each grade separation structure with respect to traffic volumes and consider at-grade intersection alternatives (for medium or long term scenarios). □ Review the route alignment south of the Murray River. □ Consider the reduction of the bridge structure at Moorangury by reviewing the grades near the proposed dam site. □ Investigate the economic advantages of initial lower cost flexible pavement with medium and long term strengthening overlays. □ Liaise with the appropriate authority to discuss the navigation clearance requirements for the new bridge on the Murray River in particular the construction, visual and cost implications. **Inner Route** □ Evaluate shortening the route by bridging across a narrow section of Lake Hume. □ Consider relocating the route to more closely follow the existing highway between Thurgoona Road and Ettamogah (near Billy Hughes Bridge). □ Consider modifying the present concept to provide southbound ramps from the inner route to the existing highway at Billy Hughes Bridge in lieu of north facing ramps at the Williams Road interchange. □ Consider relocating the corridor closer to the railway where feasible to potentially free up an area for other landuses but only if this does not compromise long term traffic capacity requirements of the route. □ Evaluate the provision of a half diamond interchange (i.e., south facing ramps) at Bridge Street with a single underpass. □ Consider a median width from Thurgoona Street southwards to allow for future expansion to six lanes (and a residual median which provides potential for eight lanes if required in the long term). □ Consider designing the bridge over the Murray River to allow for a potential infill structure for future extra lane options. □ Consider staging options to improve the economic performance of the project (i.e., consider construction of the southern end of the project initially) and thus potentially increase the priority for Federal Government funding.

(Table continued over)

Table 25.2 -- Continued

No.	Task
	For Both Routes □ Consider the treatment of the common section of road between Sweetwater Road and Bells Road as a separate project or possibly a separate stage. □ Consider the affectation to stock reserves generally but in particular the need to re-establish the reserve near Sweetwater Road. □ Consider pavement material selection options (asphalt versus concrete). □ Review/refine the cost estimates for each option. □ Investigate grade variations during detail design to reduce earthworks. □ Ensure emergency access is available to and through the routes for emergency vehicles. □ Ensure emergency services are available for roadusers (i.e., emergency phones). □ Consider the potential for savings in time and road user costs arising from a more direct route between Bowna Creek and Holbrook before making a major investment at the northern end of the project. Note: Value improvements to the Inner and outer route options should not only be assessed on technical and economic grounds but also on environment and social equity considerations. Should potential value improvement opportunities warrant a change to the current concepts, community consultation on the proposed refinements will be undertaken.
2	Test staging variations of various elements of the inner and outer routes including combinations of both (i.e., the outer route option with a duplicated bridge near the Lincoln Causeway)
3	Review the ways in which the inner route option and the outer route option support and are compatible with the existing road hierarchy to ensure an efficient and integrated network.
4	Consider the community liaison and information strategy to cover the pre-exhibition, exhibition and assessment periods as outlined in the workshop.
5	Prepare a cost estimate for developing and implementing an Environmental Management Plan.
6	Undertake the following further investigations: □ Undertake baseline monitoring of water quality, dust and noise data for ongoing comparative studies. □ Outline the principles of an Environmental Management Plan for the project.
7	Ensure the following briefing notes identified in the workshop are taken into account in the EIS/EES documentation. □ Integrated Road and Regional Development ♦ How does the project, the preferred route(s), enhance regional development? (i.e., improve access and regional movement, enhance development opportunities and reduce transport costs).

(Table continued over)

Table 25.2 -- Continued

No.	Task
	♦ How does regional development influence the project? (i.e., project timing as a result of traffic congestion, decisions to give planning certainty, infrastructure efficiency). ♦ What benefits would the inner and/or outer routes generate in the above contexts. □ National Highway Function ♦ What is the 'value' of the project in meeting the National Highway objectives and how does each route meet them. ♦ There is a need for close liaison between the implementing agency and the regional authorities. □ Integration of the Road into the Local Context ♦ Promote the project to ensure the local/regional planning processes will: – Control access – Promote compatible adjacent landuses – Utilise/maximise development opportunities. □ Alternative Staging Scenarios ♦ Need to test variations taking into account traffic and regional development benefits, timing and staging towards a long term solution. □ Intermodal Issues ♦ Need to address whether the project can be deferred by increasing rail freight, bus and cyclist movements between Albury and Wodonga. ♦ How does each route best service future rail/road freight and passenger interchanges at Albury Station. □ Government Issues ♦ Need to integrate Federal/State/local objectives and demonstrate whether they can be met by the route(s) in the medium and long term and demonstrate the benefits of so doing. ♦ Need to address if the inner route is constructed whether the outer route can be reserved for the long term on social and economic grounds.

The following chapter, Chapter 26, deals specifically with this action plan.

Chapter 26
Implementation of Action Plan

Following the adoption of the action plan (outlined in Chapter 25), the items were assessed by the working party to determine how they impacted on the project. Chapter 26 details the decisions that were made on the implementation of the action plan.

DOCUMENT LAYOUT

PART A – BACKGROUND

1. INTRODUCTION

PART B – THE PROJECT

2. NEEDS AND OBJECTIVES
3. STUDY AREA AND ALTERNATIVES
4. ROUTE DESCRIPTION
5. TRAFFIC CHARACTERISTICS AND IMPACTS

PART C – CONSULTATION

6. CONSULTATION

PART D – ENVIRONMENTAL ASSESSMENT

7. LANDFORM, GEOLOGY, SOILS AND GEOTECHNICAL ASSESSMENT
8. HYDROLOGY AND FLOODING
9. WATER QUALITY
10. SOCIO-ECONOMICS
11. METEOROLOGY AND AIR QUALITY
12. NOISE AND VIBRATION
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14. RIVERINE HABITAT
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CHAPTER 26

IMPLEMENTATION OF ACTION PLAN

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26 IMPLEMENTATION OF ACTION PLAN

This action plan relates to the work conducted in the VMS, as discussed in Chapter 25.

Following the adoption of the action plan, the items listed were assessed by the working party to determine how they impacted on the project. Decisions on implementation were reached for each of the items and are listed below.

26.1 Item 1

26.1.1 Outer Route

- **Review each of the proposed flyover structures particularly where they are in close proximity and rationalise access patterns (i.e., consider Hueske Road and Table Top/Funks/Molkentin roads)**

The location of flyover structures and rationalisation of access patterns has been reviewed and variations are feasible. The proposals, as dealt with in this EIS/EES, have not however been changed at this stage as they represent the proposed flyovers/access arrangements which were agreed to with the community during the option selection phase for the outer route corridor. It is not therefore considered appropriate to undertake changes without the prior agreement of the community. Should the community wish such changes to occur, it may be requested during the public exhibition phase of the EIS/EES.

- **Review each grade separation structure with respect to traffic volumes and consider at-grade intersection alternatives (for medium or long-term scenarios)**

The EIS/EES covers the project in its entirety and the grade separation structures are part of the ultimate overall design. Construction of grade separated interchanges in some locations could be deferred until traffic volumes warrant their provision, and at-grade intersections could be constructed in the interim. The long-term need for these facilities remains and the deferment of their construction is therefore a function of demand. The EIS/EES is based on the ultimate proposal which would include grade separated interchanges.

- **Review the route alignment south of the Murray River**

The review of the route alignment does not represent a major change from earlier concepts, relating primarily to an increase in the radius of some curves. The improvement is warranted and does not change the nature of the project, nor do the changes alter agreements that have been reached with landowners in respect of the location of the outer route. The reviewed alignment is of a design standard consistent with the rest of the route. These changes have been incorporated into the design of the outer route as proposed in this EIS/EES.

- **Consider the reduction of the bridge structure at Moorangury by reviewing the grades near the proposed dam site**

This modification does not represent a change to the proposal nor does it adversely impact on or alter agreements reached with landowners. The nominated change is a function of the final detailed design process which would be carried out if the project proceeds. It does not change any of the impact assessment undertaken as part of this EIS/EES.

- **Investigate the economic advantages of initial lower cost flexible pavement with medium long-term strengthening overlays**

This issue relates to the detailed design phase which would not be undertaken before determination of the EIS/EES.

- **Liaise with the appropriate authority to discuss the navigation clearance requirements for the new bridge on the Murray River in particular the construction, visual and cost implications**

Albury City Council is the appropriate authority in this matter. The design of the outer route, as outlined in this EIS/EES, has been undertaken to meet current navigational clearance as it relates to the requirements of the paddle steamer operation. Any allowable reduction in navigational clearance can be incorporated into the final detailed design.

26.1.2 Inner Route

- **Evaluate shortening the route by bridging across a narrow section of Lake Hume**

This alternative was considered when the original route selection criteria was developed with the community. Specifically, the community asked that due to potential hazards, e.g. pollution and environmental constraints, that no route be allowed to cross Lake Hume and both the inner and outer routes reflect this. The alternative was reviewed for the action plan and was assessed to have disadvantages which included:

- loss of existing highway corridor;
- increased agricultural impacts;
- marginally greater construction costs (approx. $26.3 million vs around $25.9 million).

- **Consider relocating the route to more closely follow the existing highway between Thurgoona Road and Ettamogah (near Billy Hughes Bridge)**

The assessment of this item revealed that it would have a higher construction cost than the identified proposal without any commensurate increase in benefits. At least two new bridges would be required over the railway line as well as a new interchange with the Olympic Way.

- **Consider modifying the present concept to provide southbound ramps from the Inner Route to the existing highway at Billy Hughes Bridge in lieu of north facing ramps at Williams Road interchange**

This item was assessed and found to have merit. Williams Road is no longer part of this project, however, the ramp would be provided as a bridge over the inner route, connecting southbound traffic to Billy Hughes Bridge.

- **Consider relocating the corridor closer to the railway where feasible to potentially free up an area for other landuses but only if this does not compromise long term traffic capacity requirements of the route**

This item was also found to have merit although some land should be retained between the corridor and the railway for buffering/vegetation/landscaping purposes where practical. The inner route has been modified to include this suggestion.

- **Evaluate the provision of a half diamond interchange (i.e., south facing ramps) at Bridge Street with a single underpass**

The EIS/EES relates to the project in its entirety which includes a full diamond (north facing ramps and south facing ramps) at Bridge Street. Construction of the north facing ramps could be deferred if traffic volumes do not warrant their provision in the short to medium term, but the long-term need for north facing ramps remains.

- **Consider a median width from Thurgoona Drive southwards to allow for future expansion to six lanes (and a residual median which provides potential for eight lanes if required in the long term)**

The proposal for the inner route now includes this provision as it was assessed that it was appropriate that the proposal should facilitate longer term options, particularly when it does not have any appreciable affect on construction costs. The assessment noted that this provision already occurred on the outer route.

- **Consider designing the bridge over the Murray River to allow for a potential infill structure for future extra lane options**

This item is an extension of the above suggestion and has been recognised as appropriate. It is, however, more relevantly a matter to be considered in a final detailed design.

- **Consider staging options to improve the economic performance of the project (i.e., consider construction of the southern end of the project initially) and thus potentially increase the priority for Federal Government funding**

This has been assessed as feasible and the option of staging is appropriate. The EIS/EES recognises the opportunities for staging but deals with the project in its entirety.

26.1.3 Both Routes

- **Consider the treatment of the common section of road between Sweetwater Road and Bells Road as a separate project or possibly a separate stage**

This is both feasible and practical, and the option of staging construction is appropriate. The EIS/EES recognises the opportunity for this section of the proposal to be staged.

- **Consider the affectation to stock reserves generally but in particular the need to re-establish the reserve near Sweetwater Road**

An assessment of this item indicated that it had merit. It has therefore been incorporated into the proposal.

- **Consider pavement material selection options (asphalt versus concrete)**

This item has merit and full consideration would be given to pavement material selection as part of the detailed design phase.

- **Review/refine the cost estimates for each option**

The EIS/EES incorporates the suggested review of costs.

- **Investigate grade variations during detail design to reduce earthworks**

As has been previously noted detailed design is likely to result in minor refinements to the concept design. Not only would grade variations be investigated during detailed design but also batter slopes, both of which are intended to minimise earthworks. It must be stressed, however, that any such refinements should only represent minor departures from the concept design which do not materially affect the assessment carried out in this EIS/EES.

- **Ensure emergency access is available to and through the routes for emergency vehicles**

This suggestion accords with community views and is appropriate. The detailed design would incorporate this provision of emergency access.

- **Ensure emergency services are available for roadusers (i.e., emergency phones)**

As with the above item, this suggestion has also been put forward by the community and for the same reasons has been incorporated into the proposal.

- **Consider the potential for savings in time and road user costs arising from a more direct route between Bowna Creek and Holbrook before making a major investment at the northern end of the project**

This suggestion involves route option considerations which extend beyond the scope of this project and constitutes a new project in itself. It is not the purpose of this EIS/EES to extend the project beyond the study area. Any such proposal to examine routes outside the study area will necessitate a full and independent environmental impact assessment for that proposal. Such a change would also not be appropriate without the prior agreement of the community.

26.2 Item 2

- **Test staging variations of various elements of the Inner and Outer Routes including combinations of both (i.e., the Outer Route Option with a duplicated bridge near the Lincoln Causeway)**

Staging variations have been examined in detail and are presented in Chapters 5 and 29 which provide quantified outcomes of various traffic scenarios resulting from these variations.

26.3 Item 3

- **Review the ways in which the Inner Route Option and the Outer Route Option support and are compatible with the existing road hierarchy to ensure an efficient and integrated network**

This has been done as part of the traffic modelling carried out for this EIS/EES. Results are shown in Chapters 5 and 27.

26.4 Item 4

- **Consider the community liaison and information strategy to cover the pre-exhibition, exhibition and assessment periods as outlined in the workshop**

This item has been considered and the strategies outlined in the VMS workshop have been adopted by the working party.

26.5 Item 5

- **Prepare a cost estimate for developing and implementing an EMP**

This suggestion has also been adopted and carried out by the working party. The cost estimate for developing and implementing an EMP is approximately $50,000.

26.6 Item 6

□ **Undertake the following further investigations**

- **Undertake baseline monitoring of water quality, dust and noise data for ongoing comparative studies**

Monitoring has been undertaken to provide a basis for assessment in this EIS/EES. Ongoing comparative studies are considered to be appropriate and baseline monitoring is essential to provide meaningful data. Following determination of the proposal by the Minister, a monitoring program should be commenced to enable the collection of data prior to the commencement of any works.

□ **Outline the principles of an EMP for the project**

The preparation of an EMP is considered to be essential to ensure safeguards are properly implemented. The principles and purpose of an EMP are discussed in Chapter 32, and an outline of the structure and contents of an EMP are included in Appendix L.

26.7 Item 7

□ **Ensure the following briefing notes identified in the workshop are taken into account in the EIS/EES documentation**

- **Integrated Road and Regional Development**

  - **How does the project, the preferred route(s), enhance regional development? (i.e., improve access and regional movement, enhance development opportunities and reduce transport costs).**

  - **How does regional development influence the project? (i.e., project timing as a result of traffic congestion, decisions to give planning certainty, infrastructure and efficiency).**

  - **What benefits would the Inner and/or Outer Route generate in the above contexts.**

Chapter 10 of the EIS/EES discusses enhancing development opportunities, reducing transport costs, infrastructure and efficiency of the project. Chapter 15 notes access and regional movement, while Chapter 30 provides an overall comparison between the two routes with regard to integrated road and regional development.

- **National Highway Function**

  - **What is the 'value' of the project in meeting the National Highway objectives and how does each Route meet them.**

  - **There is a need for close liaison between the implementing agency and the regional authorities.**

The National Highway objectives are outlined in Chapter 2. The value of the project in meeting these economic objectives is dealt with in Chapter 10, in transport terms in Chapters 5 and 27, and environmentally in Parts D and E. Details on regional authorities are contained in Chapters 6 and 16, while implementation and management are covered in Chapter 32.

- **Integration of the Road into the Local Context**

  - **Promote the project to ensure the local/regional planning processes will:**

    - **Control access**
    - **Promote compatible adjacent landuses**
    - **Utilise/maximise development opportunities.**

These matters are discussed in Chapter 15 of the EIS/EES.

- **Alternative Staging Scenarios**

  - **Need to test variations taking into account traffic and regional development benefits, timing and staging towards a long-term solution.**

These matters are identified in Chapters 3, 4 and 5 of the EIS/EES. They are further addressed in Chapters 27 and 28, with Chapter 30 providing an overall comparison.

- **Intermodal Issues**

  - **Need to address whether the project can be deferred by increasing rail freight, bus and cyclist movements between Albury and Wodonga.**

  - **How does each route best service future rail/road freight and passenger interchanges at Albury Station.**

The EIS/EES examines both routes from an environmental viewpoint but subsequent government decisions and policies would be the determining factors on these issues.

- **Government Issues**

  - **Need to integrate Federal/State/local objectives and demonstrate whether they can be met by the route(s) in the medium and long term and demonstrate the benefits of so doing.**

  - **Need to address if the Inner Route is constructed whether the Outer Route can be reserved for the long term on social and economic grounds.**

Statutory planning matters are discussed in Chapter 16 of the EIS/EES. The chapter examines Federal, State and local planning objectives and looks at the impact of the project. Specific environmental objectives are dealt with in the chapters of Part D, while wider issues (such as ESD) are contained in Part E. Details on economic and social matters can be located in Chapter 10.

PART G
COMPARATIVE ANALYSIS OF ROUTE OPTIONS

Chapter 27
Traffic and Transport Analysis of Options

This chapter presents an evaluation of the road network operating characteristics, safety issues and accessibility measures under the four strategy options, and their staging options developed in the EIS/EES for comparison.

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CHAPTER 27
TRAFFIC AND TRANSPORT ANALYSIS OF OPTIONS

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27.2 Future Traffic Estimates
27.3 Traffic Flows and Level of Service
27.4 Strategy Comparison of Road User Cost Savings (or Benefits)
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27 TRAFFIC AND TRANSPORT ANALYSIS OF OPTIONS

27.1 Future Traffic Prediction Methods

In order to describe and compare the future traffic conditions for alternative road proposals, a set of computer based traffic prediction models was required. This involved development of existing and future road networks, land use predictions and checking of the model's predictive capacity. This section describes the basis of the modelling and the road network developed to investigate the traffic implications of alternate National Highway routes and staging options for the Albury Wodonga National Highway project. The traffic model was based on the TRIPS computer package used by VicRoads. Both the Roads and Traffic Authority RTA and VicRoads agreed to the use of this package.

The model included an estimated road network based on that used previously in the *Albury–Thurgoona Arterial Roads Study* for the City of Albury. The study area was split into a number of zones and estimates of population and employment numbers developed for that study were adopted but modified to incorporate developments at Jindera, Thurgoona and Baranduda. The ultimate road network also incorporated the key main road system in Albury and Wodonga plus the future inner and outer routes as shown in Figure 27.1. Technical details of the zone system and network development are included in Appendix C.

The computer model estimates the number of trips likely to be generated by each zone based on the future projections. It also estimates how these trips will be distributed between zones (e.g., how many trips to work between a basically residential zone and each zone where jobs are located). A 'Trip Table' is formed which includes an estimate of trips between each pair of zones (including each external cordon station). The road network is simulated on the computer as a series of links (road sections) and nodes (intersections) and is described by route length, travel speeds, likely intersection delays etc. The 'Trip Table' is then 'assigned' to the road network. To do this, the computer finds the shortest time path on the network between each pair of zones and assigns the trips between the zones to the links on the selected path. Adjustments are made to travel speeds and times to take account of traffic congestion on links that may have high volumes of traffic assigned, and the process is repeated until the system is in balance.

27.1.1 Model Development

The model is a daily traffic flow model and is comprised of three traffic components, namely:

- Through traffic
- External traffic
- Internal traffic.

Through traffic is that which passes through the study area and was identified in the Origin Destination Survey. It is estimated to grow at 5% per annum. ***External traffic*** is that traffic with either an internal or external travel origin or destination in the study area and was also identified from the Origin–Destination survey. ***Internal traffic*** is local traffic within the study

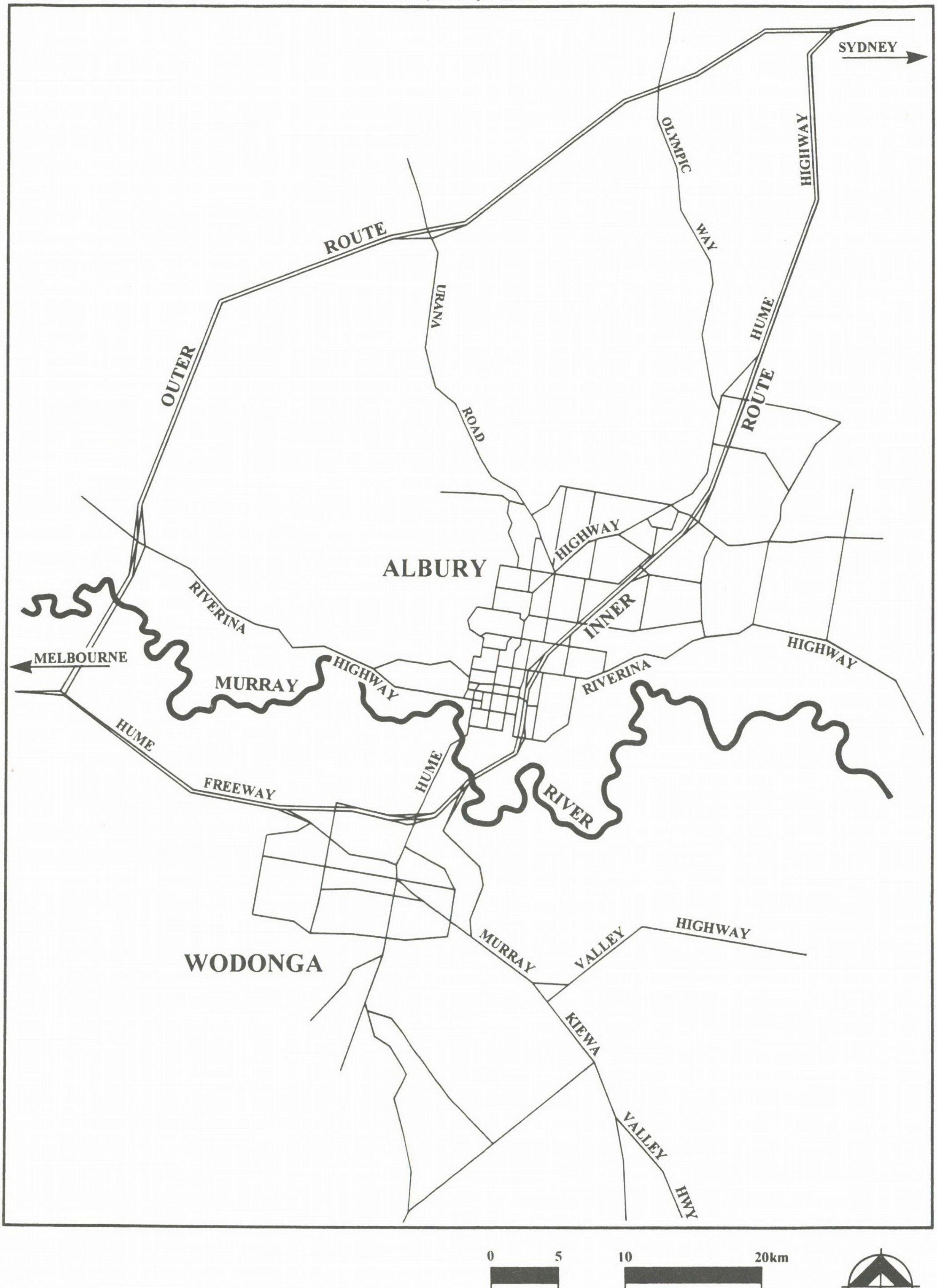

Figure 27.1

ULTIMATE ROAD NETWORK

area and was estimated by applying factors based on statistics such as population and job growth anticipated for each zone.

27.1.2 Modelling Accuracy

One of the keys to a successful modelling process is the ability to calibrate the model to reproduce existing traffic conditions. This was done by checking the model outputs against existing traffic data obtained from RTA, VicRoads and councils. Checks were carried out across 'reference' lines including the Murray River, the Main Southern Railway and North Street. The checks indicated a 92% to 98% level of accuracy when compared with existing traffic counts. These results provided a high level of confidence in the model's traffic prediction capability. Details of the calibration process are included in Working Paper 1.

27.2 Future Traffic Estimates

The prediction of future traffic for the study area through the use of the traffic model described depends on:

- scenarios of projections of future population, employment and landuse distribution;
- road networks based on the projected landuse, population and employment distribution.

27.2.1 Landuse Scenarios (2001, 2021)

Estimates of population and employment levels up to the year 2021 were made from information contained in the *Albury Wodonga Regional Planning Strategy* and supplementary information provided in discussions with the City of Albury, Rural City of Wodonga, Hume Council and the Shire of Chiltern. Rather than adopting a single set of estimates, a set of four scenarios was developed which:

- accounted for existing trends;
- assumed a middle ground position;
- assumed a set of high growth trends.

The four scenarios were:

- Low Growth Scenario
- Medium Growth Scenario
- High 1 Growth Scenario
- High 2 Growth Scenario.

Each scenario was developed for both the years 2001 and 2021, for testing by the model.

The latter two scenarios took account of alternative high growth levels in Albury and Wodonga respectively. It is important to note that the development scenarios do not constitute any formal development strategy, but rather a feasible range of future development patterns with which to check road network operations. The scenarios developed for the modelling activity were discussed and agreed with each of the councils as being a reasonable approach for transport network development and testing. Details of landuse data by transport zone incorporated in each scenario are included in Appendix C. A summary of landuse details for each scenario is shown in Table 27.1.

Table 27.1 -- Landuse Scenario Summary(1) -- (Albury Wodonga)

Scenario	Dwellings	Retail Jobs	Non Retail Jobs
Year 2001			
Low	27,690	10,670	22,760
Medium	28,990	11,310	24,040
High 1	29,900	11,880	25,230
High 2	31,710	12,440	26,430
Year 2021			
Low	37,100	12,480	37,750
Medium	42,080	14,400	38,920
High 1	43,970	15,080	40,770
High 2	49,210	17,260	46,680

(1) Figures shown have been rounded off to nearest 10.

27.2.2 Road Networks

Road networks were developed to test the following:

- Outer route
- Inner route
- Combined inner and outer routes
- Staging options.

The base network (or Do Nothing option) was also developed for comparison purposes. The base and combined network options are shown in Figure 27.1. For the purpose of network evaluation, network staging options were also developed in consultation with the local government bodies and AWDC, as follows:

- Network Stage 1 (NS1) – Inner Route from Lincoln Causeway to Borella Road.
- Network Stage 2 (NS2) – plus outer route from Barnawartha to Urana Road.
- Network Stage 3 (NS3) – plus balance of outer route to Bells Road.
- Network Stage 4 (NS4) – plus Bandiana inner route extended from Borella Road to Olympic Way.
- Network Stage 5 (NS5) – plus link from inner route to Murray Valley Highway east of Chapple street, Wodonga.
- Network Stage 6 (NS6) – plus complete inner route to Bells Road.
- Network Stage 7 (NS7) – Inner route from Lincoln Causeway to Olympic Way.
- Network Stage 8 (NS8) – Total inner route plus extension to Murray Valley Highway east of Chapple Street, Wodonga.

The network staging options are shown in Figures 27.2 (a) and (b). Network performance details (speeds, capacity, etc) are shown in *Report on Transport Modelling* prepared by Transport Modelling Services, October 1994 and are included in Working Paper 1.

27.2.3 Traffic Assignments

A total of fifty traffic assignments was conducted for the years 2001 and 2021 for landuse scenarios described in Section 27.2.1 and for the following network options:

- Base (Do Nothing)
- Outer route
- Inner route
- Combined inner and outer routes
- Staging options.

Details of all daily traffic volumes in plotted format and network operating characteristics, as well as accident model outputs, are included in two separate volumes of data titled:

- *Base Options Traffic Assignments and Accident Model*, September 1994;
- *Staging Options Network Operating Characteristics, Accident Model and Traffic Assignments*, September 1994.

Plots prepared for each assignment included:

- daily two way traffic volumes to the nearest fifty vehicles;
- directional average daily vehicle operating speeds;
- average daily volume to capacity ratios.

A discussion of the evaluation of and comparison between options is included in Sections 27.5 and 27.6.

As a means of comparing the sensitivity of predictions of vehicle movements developed from an eighty minute match time basis with that from a greater match time of 420 minutes (i.e., match time which accounts for 90% of all surveyed vehicles.), two sets of alternative traffic volume distributions were allocated to comparable networks for the year 2021, for the medium growth scenario. Comparisons between network operating characteristics for each alternative and predicted traffic volumes on critical sections of the road network were assessed and show little change. Volume/capacity ratio comparisons (ie: comparison of what a road carries to what it is designed to carry) on key sections of the network also show little change. The results are shown in Appendix C.

27.2.4 Growth Scenarios

The network staging options have been evaluated under a number of land use and population growth scenarios for the years 2001 and 2021. These land use and population scenarios

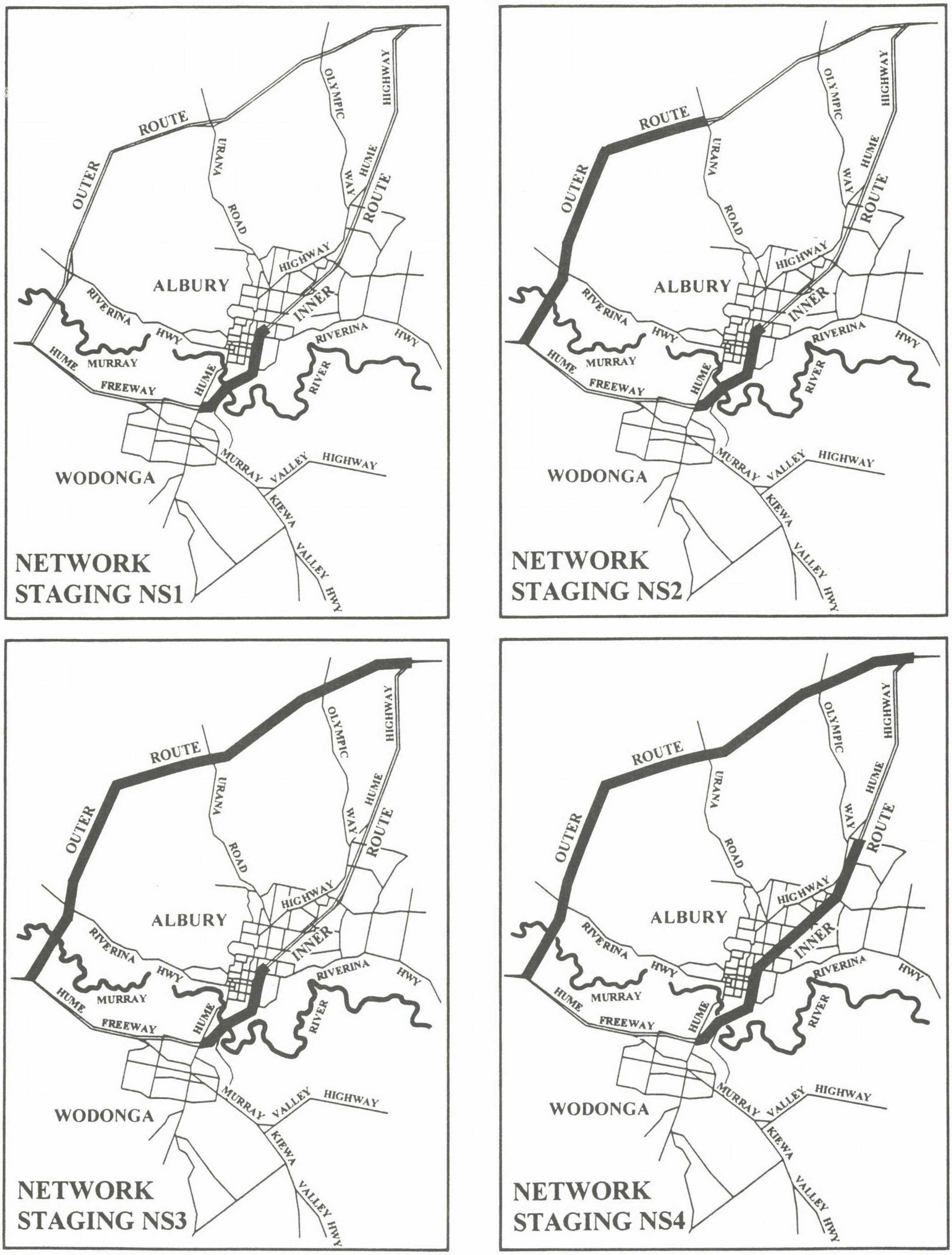

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Figure 27.2(a)

NETWORK
STAGING OPTIONS

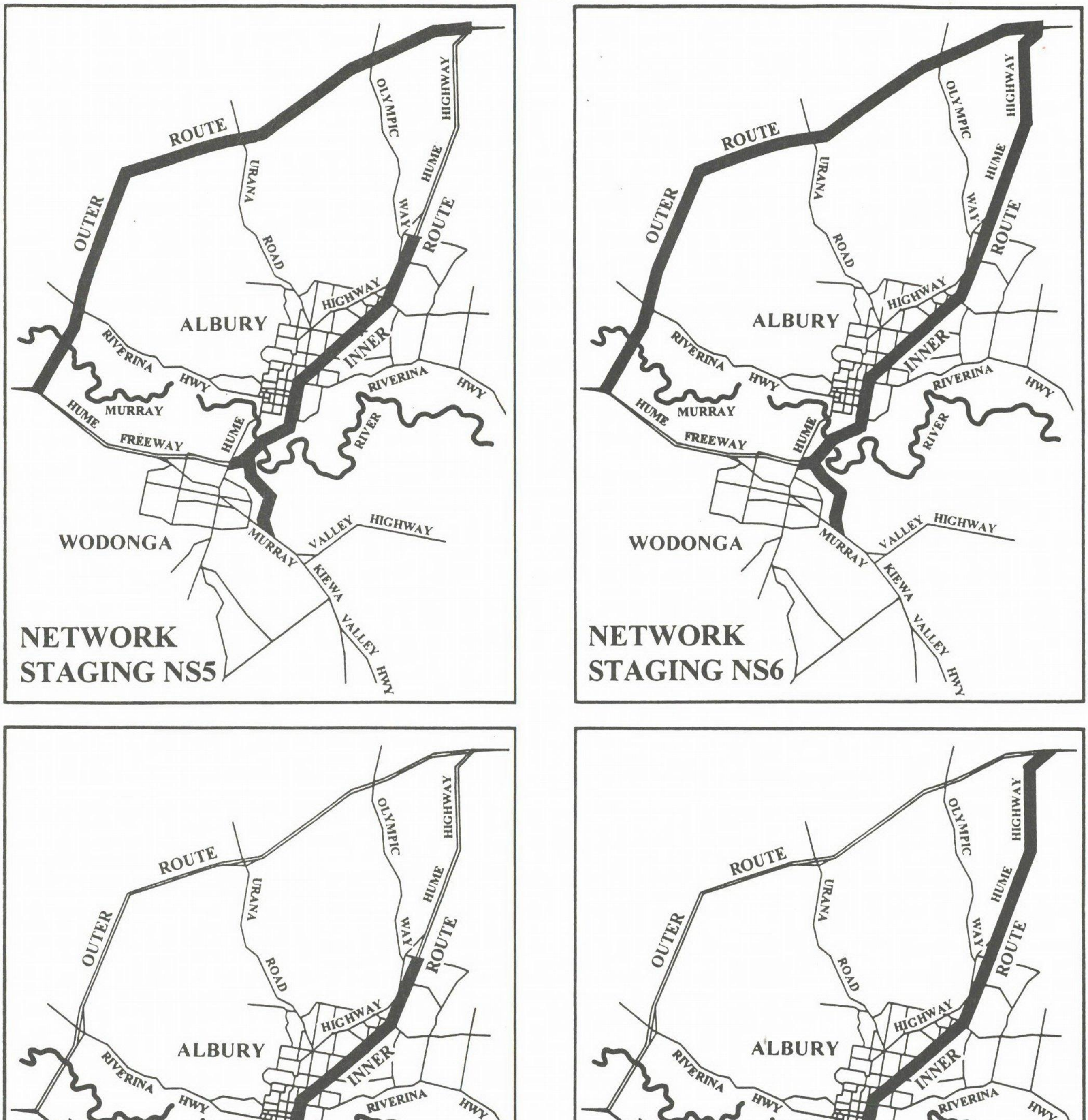

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Figure 27.2(b)

NETWORK
STAGING OPTIONS

were developed using information contained in the AWDC's *Regional Planning Strategy* and information provided by the City of Albury, the Rural City of Wodonga, Hume Council and the Shire of Chiltern. The four scenarios developed for use in the traffic operation and economic evaluations are shown in Table 27.1, and are summarised as follows:

- Low growth scenario representing approximate average annual population growth rates of 2.7% between 1991 and 2001 and 1.5% between 2001 and 2021.
- Medium growth scenario, representing approximate average annual population growth rates of 3.2% between 1991 and 2001 and 1.9% between 2001 and 2021.
- High growth 1 scenario, representing appropriate average annual population growth rates of 3.5% between 1991 and 2001 and 2.0% between 2001 and 2021.
- High growth 2 scenarios representing approximate average annual population growth rates of 4.2% between 1991 and 2001 and 2.2% between 2001 and 2021.

27.3 Traffic Flows and Level of Service

Detailed modelled traffic flow assignments were conducted for all network options under the various land use and population scenarios. The results of traffic assignments in plotted format with their network operating characteristics and accident projectives are included in the technical data reports.

A comparison of projected traffic flows on critical selected road sections of the various network strategy options for the year 2021, medium growth scenario is shown in Table 27.2.

Table 27.2 -- Traffic Flow Projections (Vehicles per Day) - 2021 Medium Growth Scenario

Road Section	Do Nothing	Inner	Outer	Both
Lincoln Causeway	61,300	20,000	54,100	19,300
Inner Route at River Murray	N/A	41,300	N/A	37,200
Outer Route at River Murray	N/A	N/A	7,200	4,800
Hume Street	25,000	17,400	24,300	17,400
Mate Street (Sth 5 ways)	27,600	23,600	25,800	23,600
Inner Route at Table Top	14,100	14,000	10,000	10,000
Outer Route at Table Top	N/A	N/A	4,100	4,100
Riverina Highway (West of Albury)	9,100	9,100	10,600	8,500

Represents traffic diverted to a new route.

A key conclusion from Table 27.2 is that even with the outer route developed, it would still be necessary to provide additional relief for traffic on the Lincoln Causeway (assumes Causeway capacity 43,000 vehicles per day at Level of Service D).

The capacity of the inner route (as a four lane freeway) across the Murray River floodplain is approximately 50,000 vehicles per day at Level of Service B (National Highway criteria for design) and 65,000 vehicles per day at Level of Service C (for good urban operation). If design facilitates future widening to six lanes, respective capacities for the respective levels of service would be 75,000 and 97,000 vehicles per day. This would provide sufficient capacity across the river to cater for internal and through traffic movements beyond the middle of the next century (2050+), whether the outer route is built or not.

27.4 Strategy Comparison of Road User Cost Savings (or Benefits)

27.4.1 Daily Road User Cost Savings

A comparison of road user cost savings from the model output between the future strategies and the do nothing strategy is shown in Table 27.3. These cost savings include savings in vehicle operating costs and travel times and are calculated using the Do Nothing option as a base in accordance with a VicRoads model (AD Boyd with National Road Transport Commission). The unit cost for time savings, was taken to be $25/hour, as adopted in the economic analysis in Chapter 10. The cost savings do not include savings in potential accident reduction due to the proposed improvement options.

Table 27.3 -- Daily Road User Cost Savings ($/day)*

Year 2001

Option	Low Growth	Medium Growth	High Growth 1	High Growth 2
Base/Do Nothing	-	-	-	-
Outer Route	21,800	24,400	24,300	29,200
Inner Route	65,800	74,100	80,100	94,000
Combined	71,400	79,600	85,800	99,980

Year 2021

Option	Low Growth	Medium Growth	High Growth 1	High Growth 2
Base/Do Nothing	-	-	-	-
Outer Route	59,700	86,800	102,600	148,100
Inner Route	131,900	183,100	204,500	278,900
Combined	143,900	196,000	217,600	293,400

* Rounded off to the nearest 100.

It can be concluded from Table 27.3 that the road user cost savings for the inner route represent around two to three times the cost savings for the outer route and that the additional savings (benefits) of building both are marginal.

27.4.2 Annual Road User Cost Savings

In terms of annual road user, cost savings, using 300 days in the year to reflect discounts for weekends and public holidays, for the year 2021 medium growth scenario, the inner route represents a cost saving of $55 million compared with $26 million for the outer route. The annual cost savings for the medium growth scenario for the various network options are shown in Table 27.4.

Table 27.4 -- Annual Cost Savings for Medium Growth Scenario

	Annual Road User Cost Savings in Million Dollars	
Strategy Option	**2001**	**2021**
Do Nothing	-	-
Outer Route	7.32	26.04
Inner Route	22.23	54.93
Combined	23.88	58.80

The relatively small increase in cost savings for the combined option when compared with the inner route option, indicates that there is little justification in expending the $386 million capital investment required to construct both the inner and outer options to realise the small annual marginal cost savings of up to some $3.9m. The economic implications are discussed in Chapter 10 of this document.

27.5 Staging Options and Road User Cost Savings (or Benefits)

This section discusses the various staging options (as set out in Section 27.1.2) and their road user benefits in terms of cost savings. The model analysis provided road user cost savings for each stage development Option as described in Section 27.1.2. The road user benefit comparison between each staging option for years 2001 and 2021, medium growth scenario, is illustrated in Table 27.4.

Table 27.5 -- Network Staging Options Road User Benefit Comparisons

Staging Option (refer Section 27.1.2)	Annual Road User Cost Savings in Million Dollars Year 2001	Year 2021
NS 1 - (Inner to Borella Road)	13.95	40.35
NS 2 - (NS1 plus outer to Urana Road)	14.49	41.76
NS 3 - (NS2 plus outer to Bells Road)	18.54	51.15
NS 4 - (NS3 plus inner to Olympic Way)	23.22	57.54
NS 5 - (NS4 plus Bandiana Link)	26.58	65.76
NS 6 - (NS5 plus inner to Bells Road)	27.27	66.99
NS 7 - (Inner to Olympic Way)	21.06	50.73
NS 8 - (NS7 plus Bandiana Link)	25.59	63.30

27.5.1 Inner Route Staging

Five construction stages have been proposed for the inner route option as discussed in chapter 22. The road user benefits are described as follows:

Construction Stage 1: From the interchange with the Hume Freeway at Lincoln Causeway to Borella Road (NS1).

The short-term benefit of network staging option NS1 is substantial, representing annual road user cost saving of $13.95 million compared with that of $7.32 million for the entire outer route. This improvement option would incorporate interchanges at the Lincoln Causeway at Bridge Street, and terminal treatment at Borella Road. This network staging option would provide a bypass of the Hume Street area and reduce traffic demand on the Lincoln Causeway. This option would require an interim rearrangement of the syndicate intersection at Borella Road and Hume Highway. The NS1 staging option would cost $69 million. Long-term benefits of this staging option (to the year 2021) would be $40.35 million.

Construction Stage 2: From Borella Road to Table Top (NS7)

By extending the inner route from Borella Road to Table Top, the short term benefit in road user cost savings on the network (to the year 2001) would be $21.06 million per annum. This increases the savings from NS1 by $7.11 million and economically represents a superior option than to proceed to Network Staging NS2 and NS3. The long term benefits are $10.38 million per annum.

Construction Stage 3: From Table Top to Bells Road

The next recommended stage would be to continue the inner route by extending Network Staging NS7 from the Olympic Way to Bells Road. This option would result in a further annual benefit of $1.17 million in 2001 and $4.2 million per annum by 2021.

Construction Stages 4 and 5: Bells Road to Sweetwater Road

Further stages of the inner route consisting of the section between Bells Road and Sweetwater Road are common with part of the outer route. These sections of the road improvement have not been modelled to evaluate their user cost benefits.

Bandiana Link

A further improvement to the completed inner route would be to extend its southern end to link up with the Murray Valley Highway as indicated in Network Staging NS8. A further benefit of $3.36 million per annum would be realised in the short term and $4.5 million per annum in the long term. The implementation of this stage has not been determined and the cost for this improvement has been estimated at $11 million.

27.5.2 Outer Route Staging

Five construction stages have also been proposed for the outer route option. The road user benefits are described as follows:

Construction Stages 1 and 2: From the interchange with the Hume Freeway to the Urana Road junction.

Construction Stage 1 and Construction Stage 2 have been combined in the modelling analysis as Network Staging NS2 (which includes NS1). The outer route consists of the length between the interchange with Hume Freeway and Urana Road junction. The road user benefit for these two stages is very small, amounting to only $0.54 million per annum in the short term and $1.41 million per annum in the long term.

Construction Stage 3: Urana Road junction to Bells Road

Construction Stage 3 of the outer route extends the route to Bells Road, with the road user benefits increasing to $4.59 million per annum in the short term and $10.8 million per annum in the long term.

Construction Stage 4 and 5: Bells Road to Sweetwater Road

As discussed in the inner route staging evaluation above, Stages 4 and 5 which involve the extension of the new route from Bells Road to Sweetwater Road are common to both the inner and outer routes and have not been modelled. The benefits would be common to both route options.

27.5.3 Combined Route (Inner and Outer) Staging

The combined route option of both inner and outer routes has not been considered in Chapter 22 for the detailed construction program and cost estimates. For the purpose of evaluation in this chapter, it has been assumed that the combined route option could be divided into six construction stages.

Construction Stage 1:	Which is the same as Network Staging NS1 (or Stage 1 of the inner route option).
Construction Stage 2:	Which essentially completes the outer route (i.e., outer route Stages 1, 2 and 3) plus Staging NS1.
Construction Stage 3:	Which proceeds from Network Staging NS3 to NS4 (extension of the inner route from Borella Road to the Olympic Way at Table Top, i.e., inner route Stage 2).
Construction Stage 4:	Which completes the inner route to Bells Road (i.e., inner route Stage 3).
Construction Stage 5 and 6:	Which are the common section of the routes from Bells Road to Sweetwater Road (i.e., inner and outer routes Stages 4 and 5).

The majority of the benefits come from Stage 1, which is also Stage 1 of the inner route. In the short term (to year 2001), this amounts to over 58% of the total savings of $23.88 million per annum.

In the long-term savings (to the year 2021), the first stage saving amounts to $40.35 million per annum, or over 68% of the total benefits of $58.8 million per annum.

The benefits compared with the Do Nothing option for each stage of construction of the inner, outer and combined routes (for the medium growth scenario) are shown in Table 27.6.

Table 27.6 -- Incremental Benefit Comparison (Medium Growth Scenario)

Construction Stage Development	Approximate Construction Cost ($M)	Road Users Benefits ($M per annum) 2001	Road Users Benefits ($M per annum) 2021
A Inner Route Only			
Stage 1	69	13.95	40.35
Stage 2	47	7.11	10.38
Stage 3	17	1.17	4.20
Stages 4 and 5	48	-	-
Total complete	181(1)	22.23	54.93
B Outer Route Only			
Stage 1	84	0.77	3.01
Stage 2	72	(2)	(2)
Stage 3	37	6.55	23.03
Stages 4 and 5	61	-	-
Total Complete	254(1)	7.32	26.04
C Combined Inner and Outer Routes (CR)			
Stage 1	68	13.95	40.35
Stage 2	193	4.59	10.80
Stage 3	47	4.68	6.40
Stage 4	17	0.66	1.26
Stage 5 & 6	61	-	-
Total Complete	386(1)	23.88	58.8
D Bandiana	11(1)	3.36	8.22

NA = Not applicable.

(1) Construction cost only
(2) The road user benefits were combined for Stages 1 and 2.

27.5.4 Conclusions

The evaluation of road user benefits of each alternative route and its staging option as summarised in Table 27.6 clearly indicates that the inner route is a preferred option in terms of construction cost and incremental road user benefits obtained for each stage of the construction both in the short term (to year 2001) and in the long term (year 2021).

At a construction cost of around $69 million, the first stage of the inner route shows significantly high cost savings of $13.95 million per annum in the short term (year 2001) and $40.35 million per annum in the long term (year 2021). These savings account for more than half the total savings for the entire inner route option and almost twice the cost savings for the entire outer route option.

It is also interesting to note that the road user cost savings for the combined inner and outer routes do not increase the overall benefits by a significant level compared with the inner route option.

It is also worthwhile to note that by constructing the Bandiana Link between the Lincoln Causeway and the Murray Valley Highway together with the entire inner route, the total benefits in user road cost savings would be higher than by constructing the combined inner and outer routes.

Given the above analysis, it is doubtful whether the construction of the outer route alone could be considered worthwhile on economic grounds. As indicated earlier in this section, the capacity of the inner route could be increased within the existing cross-section envelope to cater for the estimated traffic demand beyond the middle of the next century.

27.6 Safety

Computer models were developed to estimate changes in accident occurrence at key intersections and mid-blocks sections. The safety factor was therefore measured in terms of these changes.

27.6.1 Mid-Block Accident Occurrence

Mid-block accidents were estimated by the model using the different accident rates for different road types derived by the VicRoad Urban Evaluation Model. These rates are measured in casualty accidents per 100 million vehicle kilometres per annum. The average rates for Victoria for the past three years are:

- Local Roads 32
- Undivided Roads 23
- Divided Roads 19
- Freeway 13

The daily vehicle kilometres predicted by the model show that there is little or no difference in travel on local roads, and it is therefore assumed that there would be no change in mid block accidents in the local network owing to the bypass proposals. The projected mid-block accident occurrence per annum for the year 2001 and year 2021 scenarios at major roads was therefore calculated by multiplying the rates applied to the annual vehicle kilometres travelled on the different road types other than local roads. The comparisons are shown in Table 27.7.

27.6.2 Intersection Accidents

This model also calculated the casualty accident number at the major intersections selected for analysis. Accident rates (averaged over 5 years) were applied to each intersection using existing data and on the assumption that accident rates per approaching vehicles would remain constant over time (refer to Austroads Section 4 - Road Crashes 1988). Changing traffic volumes at each intersection and the elimination of a number of intersections under analysis result in the reduction of accident occurrence for each option tested. The accident rates for the selected intersections vary from six accidents per 100 million approaching vehicles per annum at the intersection of High and Osborne Street in Wodonga to 45 accidents per 100 million approaching vehicles per annum at the intersection of Beechworth Road and the Murray Valley Highway. The projected accident occurrence per annum for the year 2001 and year 2021 scenarios at major selected intersections is shown in Table 27.7.

Table 27.7 -- Casualty Accident Prediction Comparison (Number per annum)

	Mid-block		Intersections	
Strategy	**2001**	**2021**	**2001**	**2021**
Do nothing	131	208	76	100
Inner	121	192	64	82
Outer	129	204	74	96
Combined	120	190	63	81

The total predicted accident reduction per annum (mid-block sections and intersections) compared with the do nothing strategy for both 2001 and 2021 scenarios is shown in Table 27.8.

Table 27.8 -- Total Casualty Accident Reduction Per Annum (Number per annum)

Strategy	2001	2021
Inner	22	34
Outer	4	8
Combined	24	37

The above table shows a greater potential for the inner route option to reduce accident occurrence on the major road network. The small reduction in projected accident occurrence for the outer route is attributed to the fact that, with the implementation of the outer route, there would still be a large volume of traffic on the existing major road system through the townships of Albury and Wodonga, giving little opportunity for reducing the vehicle kilometre travel on the existing road system.

The average cost per casualty accident varies between urban road and rural road and also varies between Victoria and NSW.

The Australian Road Research Board (ARRB) *Road User Costs for Economic Evaluation of Roadworks* by Taylor/Thoreson in August 1992 quotes an average cost of $25,900 per injury accident. The *Economic Analysis Manual* prepared by the NSW RTA derives an average cost of a reported urban accident (1994 dollar) to be $38,600, and the corresponding value for the reported rural road accident (outside country towns) as defined by the Australian Bureau of Statistics is $84,700. VicRoads uses a figure of $95,000 per casualty accident.

Since Albury Wodonga is classified as urban, an average cost of $38,600 per reported accident has been adopted. Given the discussions in the previous paragraph, it is acknowledged that accident costs and hence accident cost savings could be conservative. The comparative cost savings per annum (1994 dollar) when compared with the do nothing strategy are shown in Table 27.9.

Table 27.9 -- Accident Cost Saving Comparison

Strategy	2001 $ per annum	2021 $ per annum
Inner	849,200	1,168,400
Outer	154,400	308,800
Combined	926,400	1,428,200

The total projected accident cost savings over the twenty year period (2001–2021) in 1994 dollars for the inner route strategy is over five times that for the outer route, confirming the added benefit of developing the inner route over the outer route in terms of accident cost savings.

27.7 Accessibility

Accessibility factors were evaluated to measure the effect that any road development might have on employment or residential development.

The model enables the following factors to be evaluated for each of the strategy options developed:

- Residential Location – jobs within fifteen minutes of travel time of residential zones;

- Employment activities - population within fifteen minutes travel time of employment areas.

The model evaluates every zone for all options tested. The comparative changes over the Do Nothing option for year 2021, Medium Growth Scenario are included in the technical report *Accessibility Measures at Mid-Block Accident Model 1994*. As an illustration, six zones have been selected for comparison. These zones represent locations of commercial, industrial, and other land use developments. The potential changes in employment and populations within fifteen minutes of travel time of each road strategy option provides a measure of the degree of importance in the accessibility of each option. Table 27.10 illustrates the key zones in Albury Wodonga and their accessibility measures for the strategy options in the year 2021.

The selected zones for comparison include:

Central Albury	- Zone 5	- Commercial
West Albury	- Zone 18	- Residential
Jindera	- Zone 16	- Industrial/Rural/Residential
Thurgoona	- Zone 27	- Industrial
Central Wodonga	- Zone 40	- Commercial
Baranduda	- Zone 44	- Rural/Residential

Table 27.10 -- Typical Accessibility Comparisons

Option	A: Population within 15 minutes Travel Time					
	Central Albury Zone 5	Jindera Zone 16	West Albury Zone 18	Thurgoona Zone 27	Central Wodonga Zone 40	Barandula Zone 44
Base	50,200	48,300	38,700	56,100	56,100	54,500
Outer Route	66,100	48,300	41,100	56,100	67,300	54,500
Inner Route	100,000	44,300	62,100	72,400	94,600	70,200
Combined	100,200	44,300	62,100	72,400	94,600	70,200
Option	**B: Industries and Employment within 15 minutes Travel Time**					
	Central Albury Zone 5	Jindera Zone 16	West Albury Zone 18	Thurgoona Zone 27	Central Wodonga Zone 40	Barandula Zone 44
Base	27,200	21,000	24,000	28,300	28,600	24,200
Outer Route	36,800	21,000	26,900	28,300	36,400	24,200
Inner Route	46,100	26,600	36,700	40,000	48,000	37,600
Combined	48,700	26,600	36,700	40,000	48,000	37,600

Table 27.10 shows that the study region would benefit from either the outer route or the inner route in terms of accessibility to employment centres (both industrial and business), as well as accessibility of each zone in terms of the potential for development. However, most of the zones in the region appear to benefit more from the inner route than the outer route. There is little difference in comparative benefits between the inner route and the combined route options.

The model, however, does not assess the value of a particular option in terms of facilitating access by non-urban residents to major population centres. Although both options appear to attract non-urban residents to Albury and Wodonga in a similar manner, the inner route would have the advantage of attracting those within fifteen minutes of travel. Both inner and outer route options would contribute to facilitating overseas or interstate industrial and commercial trade in a similar manner by facilitating through movements. The through traffic which does not have reason to stop at Albury or Wodonga may find the outer route more attractive, but the majority of traffic which may have reason to stop, would be likely to find the inner route a better option. Previous discussions have indicated that the through traffic bypassing the Albury Wodonga centre would be only a small percentage of total traffic using the proposed facility. The inner route appears to cater adequately for both types of traffic.

Chapter 28
Methodology for Strategy Evaluation

Chapter 28 sets out the methodology that will be used to evaluate the various strategies outlined earlier and discusses the use of weighted and non–weighted matrices.

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CHAPTER 28
METHODOLOGY FOR STRATEGY EVALUATION

28 METHODOLOGY FOR STRATEGY EVALUATION

28.1 Methodology

This EIS/EES provides an environmental assessment of two alternative routes – the inner and outer. As discussed in Chapter 22, there are a number of construction staging options associated with each or both of the routes. These options have implications for expenditure on the project and the timing of construction. Separate to these construction staging options for each of the inner and outer routes, a number of strategies exist for the implementation of a National Highway route at Albury Wodonga. These strategies are described in Chapter 2 together with an assessment of how they meet the project objectives.

These strategies are drawn together in Chapter 29 and are subjected to an initial review which rejects some from further consideration.

As the project is a traffic and transportation project, traffic and transportation becomes one of the key issues which need to be considered in the evaluation of strategies. The project would also have ramifications in respect of social issues, the physical environment and economic issues. These four categories (transport, social, environmental and economics) provide a focus for the strategy evaluation as they collectively encompass the matters of significance addressed by this EIS/EES, as listed in Section 1.3, in the manner shown below.

Transport:	traffic characteristics and impacts
Social:	social concerns noise and vibration impacts landuse and property impacts operational hazards and risks planning controls archaeology/heritage
Physical Environment:	landform, geology and soils geotechnical issues hydrology and flooding water quality climatic assessment air quality flora and fauna riverine habitat landscape and visual impact current ecological issues
Economics:	economic issues energy conservation/savings

While none of these four key issues is considered of greater or lesser importance, traffic and transportation comparisons are discussed separately in Chapter 27 because of the complexities involved in providing modelled comparisons of the options.

28.2 Strategy Evaluation Matrix

A strategy evaluation matrix has been developed which, together with other decision making information, allows comparison of a strategy from a series of candidate alternatives (see Chapters 30 and 31).

The matrix is a decision-making tool which is structured and completed to help assess the key factors and to guide effective decision making in either supporting or not supporting a project strategy. There are two kinds of matrices which can be used: a **weighted** or **non-weighted matrix**. Different matrices may be applicable to different kinds of projects. The choice of matrix is determined depending upon the dominance of a single issue such as construction costs, or a series of issues such as construction costs, visual impacts, loss of native flora and the like.

28.2.1 Weighted Matrix

This essentially means that the importance of issues is quantified and issues are given greater or lesser importance explicitly when compared with other issues. This is usually done by the proponent of the project.

For example, if the system of weighting is applied, an issue such as cost of construction could be perceived by some to have far more importance and therefore attract 'heavier' weighting than, say riverine habitat under environmental issues or number of dwellings to be affected under socio-economic issues. Conversely, others may argue strongly that environmental and/or socio-economic issues are worthy of more consideration than issues grouped under the heading of transportation issues.

28.2.2 Non-weighted Matrix

The non-weighted matrix allows the reader and the decision maker to give their own subjective weights to the issues.

Preliminary investigations undertaken by the study team during the course of the project did not produce a unanimously supportable dominant issue or series of issues. There were, however, some matters which were of more concern to particular individuals, authorities or organisations. For example, some individuals showed concern because they are directly affected by a particular option.

28.3 Conclusion

In deciding the kind of matrix to be used, two questions were asked:

- □ Can a series of community acceptable and statistically correct weightings be developed that would be supported by those having some interest or involvement in the project as a whole?

- □ If no dominant issue is clearly stated or otherwise derived by this study, should all issues be considered to be equally important?

It was concluded after consideration by the study team that adoption of a weighted matrix would not be appropriate since there was no unanimous view within the community of the relative importance of each of the key factors, nor could such weighting be assigned without a high level of subjectivity. 'Weightings' were considered in this case to be not uniformly held by sectional interests.

It was therefore decided to use a non-weighted matrix as a tool to compare options, in order to limit potential bias being introduced into the EIS/EES.

Chapter 29
Development of Strategies

The development of strategies chapter details the context and implications of the nine derived strategies for both the inner and outer routes and narrows down to five the potential strategies which are to be considered in greater detail in Chapters 30 and 31.

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CHAPTER 29

DEVELOPMENT OF STRATEGIES

29 DEVELOPMENT OF STRATEGIES

29.1 Approach

Nine possible strategies can be generated in respect of the inner and outer routes. They result from three possibilities that can occur regarding each route, being: the route is built now (i.e., as soon as funds become available); the route is reserved or built later (i.e. the reservation is protected for future construction when funds become available); and the route is abandoned. The nine strategies are developed from the matrix in Table 29.1 and are as follows:

- A – Build both the inner and outer routes now;
- B – Build the inner route now and reserve the outer route to be built later;
- C – Build the inner route now and abandon the outer route;
- D – Build the outer route now and reserve the inner route to be built later;
- E – Reserve both the inner and outer routes and build them both later;
- F – Reserve the inner route to be built later and abandon the outer route;
- G – Build the outer route now and abandon the inner route;
- H – Reserve the outer route to be built later and abandon the inner route;
- I – Abandon both the inner and outer route (Do Nothing).

29.2 Context and Implications of Strategies

The evaluation indicates that a new route is warranted. It is apparent that a second river crossing between Albury and Wodonga is clearly warranted within the next few years. While the strategies are discussed in detail in the following section, the broad context and implications of the strategies have been examined separately.

Construction of both the inner and outer route is now dependent upon the ability to provide substantial road building funds to the project. Some $465 million dollars would be needed for the construction of both routes to a four–lane standard or $360 million for construction of both routes to a two–lane standard with overtaking lanes. It may not be possible for this sum of money to be made available from existing government road building budgets and alternative funding scenarios would need to be considered. It is not the purpose of this study, however, to identify funding options for this project, such decisions being dependent upon government policies.

If a decision is made not to build the outer route now, two other important decisions have to be made. The alignment of the outer route should be confirmed and incorporated into the Council environmental planning instruments if it is intended that construction would occur in the future. Local communities and landowners along the outer route should not remain in doubt on this issue. If, on the other hand, it is decided that the outer route would not be built, either now or in the future, then all proposals for the route should be formally abandoned and all parties (i.e., landowners, communities, local government) be advised that the outer route has been abandoned.

If a decision is made to reserve, but not to build, the inner route or abandon the inner route, other decisions also need to be made. The construction of a second river crossing to alleviate congestion on the Lincoln Causeway would be necessary. Responsibilities for funding and construction need to be clearly identified and action implemented to avoid an unacceptable traffic situation occurring on the Lincoln Causeway. A decision to abandon the inner route would require reassessment of landuse and traffic strategies to cope with the existing transportation issues.

29.3 Discussion of Strategies

Table 29.1 provides a graphic presentation of the possible strategies for the project which are discussed below.

Table 29.1 -- Possible Strategies

		OUTER ROUTE		
		BUILD NOW	RESERVE	ABANDON
INNER ROUTE	BUILD NOW	A	B	C
	RESERVE	D	E	F
	ABANDON	G	H	I

Note: ▒ = Strategy identified and further evaluated

□ = Strategy identified but not dealt with further

Strategy A -- Build Both Routes

This strategy depends upon the provision of substantial monies (approximately $465 m). The environmental impact assessment provided in this EIS/EES shows that with appropriate safeguards in place there are no environmental reasons why either route should not be built. Access to adequate funds would therefore be a reason preventing implementation of this strategy. There is also the issue of whether scarce funds could be allocated to the extent required by this strategy, given competing priorities in other areas. While the strategy would capture the non-economic benefits and disadvantages of each of the route options they cannot simply be added together. For example, the construction of both routes would result in an over provision of road space which would lead to less value being realised than from each route individually. This strategy is not dealt with any further.

Strategy B -- Build Inner Route and Reserve Outer Route

Construction of one route now and providing the opportunity for future construction of the other route would provide short-term benefits while not precluding the longer term opportunity of developing the other route. This strategy is further evaluated in Chapter 30.

Strategy C -- Build Inner Route and Abandon Outer Route

This strategy would reduce initial costs and would resolve discussion on which route should be built. It is further evaluated in Chapter 30.

Strategy D -- Build Outer Route and Reserve Inner Route

Construction of one route now and providing the opportunity for future construction of the other route would provide short-term benefits while not precluding the longer term opportunity of developing the other route. This strategy is further evaluated in Chapter 30.

Strategy E -- Reserve Inner and Outer Routes but build later

Adoption of this strategy would do nothing to resolve discussion on which route should be built first. It would delay decision making on construction of a National Highway route without alleviating any of the problems associated with the existing situation. This strategy is not therefore dealt with any further.

Strategy F -- Reserve Inner Route and Build Later and Abandon Outer Route

The only issue that this strategy resolves is any uncertainty in relation to the outer route although it is possible that until construction of the inner route commenced there may be ongoing doubts about whether the outer route option would be resurrected. The strategy fails to alleviate most of the existing problems and is not dealt with any further.

Strategy G -- Build Outer Route and Abandon Inner Route

This strategy would reduce initial costs and would resolve discussion on which route should be built. It is further evaluated in Chapter 30.

Strategy H -- Reserve Outer Route and Build Later and Abandon Inner Route

The comments provided above in respect of Strategy G also apply to this strategy with the converse situation that doubts may continue to exist about whether the inner route option would be resurrected. The strategy therefore fails to alleviate most of the existing problems and is not dealt with any further.

Strategy I -- Abandon Both Routes

This strategy is the 'Do Nothing' option. It fails to deal with almost all the existing problems and has not been pursued further other than to use it as a base case situation for comparison.

29.4 Conclusion

Nine possible strategies have been generated in respect of the inner and outer routes. Four strategies are not considered further.

Strategies which will not be considered further are:

- A – Build both routes now
- E – Reserve inner and outer routes but build later
- F – Reserve inner route and build later and abandon outer route
- H – Reserve outer route and build later and abandon inner route.

Strategies which are considered in more detail in Chapters 30 and 31 are:

- B – Build inner route and reserve outer route
- C – Build inner route and abandon outer route
- D – Build outer route and reserve inner route
- G – Build outer route and abandon inner route
- I – Abandon both routes (the Do Nothing option).

Chapter 30
Overall Comparison

Chapter 30 evaluates the development strategies and provides an overall comparison on the basis of the key factors identified in Chapter 29.

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CHAPTER 30

OVERALL COMPARISON

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30 OVERALL COMPARISON

This chapter evaluates the development strategies against key objectives to provide a comparison between the strategies.

The project objectives, as endorsed during the VMS (see Section 25.3.2) included the following three time frame objectives:

- addressing short term issues where practicable, i.e, within the next few years;
- accommodating medium term needs, i.e, within the next 25 years;
- providing the scope to accommodate long term needs, i.e, more than 25 years.

This chapter deals with the short to medium time frame objectives.

A separate discussion on the long-term time frame objective is provided in Chapter 31.

30.1 The Non-Weighted Evaluation Matrix

Chapter 28 describes the differences between a weighted and non-weighted matrix. A non-weighted matrix has been selected. Objectives were grouped under each of the key factors -- physical environment, social issues, economics and transport. Each of the selected strategies including the Do Nothing strategy (i.e., abandon the inner and outer routes) is compared in the context of the objectives for the key factors.

30.2 Strategies Evaluated

Five strategies were selected for evaluation in Chapter 29 and are shown in Table 30.1.

Table 30.1 -- Strategies Evaluated

		OUTER ROUTE		
		BUILD NOW	RESERVE	ABANDON
INNER ROUTE	BUILD NOW		B	C
	RESERVE	D		
	ABANDON	G		I

The five strategies comprise the following:

- B - Construct inner route now reserve outer route for future construction
- C - Construct inner route now abandon outer route

- D - Outer route now reserve inner route for future construction
- G - Construct outer route now abandon inner route
- I - Abandon inner and outer routes i.e., the 'Do Nothing' option. It is the base case for comparative options.

These strategies are compared in Table 30.2.

30.3 Objectives of Key Factors

The identification of objectives to assist in more clearly focusing on the key factors is of great benefit in this type of study. To ensure consistency, the project objectives have been grouped under each of the key issues as follows:

- **Transport**

◆ To improve existing road and traffic conditions
◆ To improve interstate linkages
◆ To improve intercity linkages

- **Physical Environment**

◆ To minimise adverse impacts on the environment
◆ To safeguard and enhance environmental amenity where possible
◆ To contribute to Ecologically Sustainable Development

- **Social**

◆ To minimise adverse impact on the community
◆ To improve regional amenity
◆ To improve road safety
◆ To complement urban development strategies

- **Economic**

◆ To achieve a cost effective solution
◆ To reduce total travel costs and travel time
◆ To facilitate commercial activity

Some additional identified objectives were not included in the evaluation process. Their exclusion reflected the fact that each was met by the strategies equally well and did not therefore provide meaningful comparison. These objectives were:

- facilitate regional trade, commerce and tourism;
- provide limited access to the new highway route;
- provide consistent traffic conditions along the highway.

30.4 Evaluation Criteria

The evaluation process consists of identifying the manner in which the strategy satisfies the stated objectives. To achieve consistency, each of the strategies was placed at a point along a continuous line ranging from best satisfies the objective to least satisfies the objectives as follows:

best satisfies objective | least satisfies objective

This system of evaluation enables more than one strategy to meet an objective in the same manner. It also allows both slight and significant differences in the manner in which a strategy satisfies an objective to be acknowledged rather than a ranking system which might not recognise that strategies are not evenly spaced between best satisfying the objective and least satisfying the objective.

30.5 Strategy Evaluation

Following the identification of objectives, strategies to be evaluated and evaluation criteria, each strategy was examined against the individual objectives. A summary of the evaluation is presented in Table 30.2. The logic and discussion relating to evaluation are presented below.

Table 30.1 -- Strategy Comparison Matrix - (Short- to Medium-Term Needs)

Key Factor & Objectives	Strategies				
	'B' Inner Now Reserve Outer	'C' Inner Now Abandon Outer	'D' Outer Now Reserve Inner	'G' Outer Now Abandon Inner	'I' Abandon Inner and Outer
TRANSPORT					
• To improve existing road and traffic conditions					
• To improve interstate linkages					
• To improve intercity linkages					
PHYSICAL ENVIRONMENT					
• To minimise adverse impacts on the environment					
• To safeguard and enhance environmental amenity where possible					
• To contribute to ESD					

(Table continued over)

Note: best satisfies objectives ... least satisfies objectives

Table 30.1 -- Continued

Key Factor & Objectives	Strategies				
	'B' Inner Now Reserve Outer	'C' Inner Now Abandon Outer	'D' Outer Now Reserve Inner	'G' Outer Now Abandon Inner	'I' Abandon Inner and Outer
SOCIAL					
• To minimise adverse impacts on the community					
• To improve regional amenity					
• To improve road safety					
• To complement urban development stratergies					
ECONOMIC					
• To achieve a cost effective solution					
• To reduce total travel costs and time					
• To facilitate commercial activity					

30.5.1 Transport

Objective: to improve existing road and traffic conditions

Strategy I (abandon inner and outer routes) was assessed as least satisfying the objective. It represents the 'Do Nothing' option and would not provide any improvement to road and traffic conditions since it would not result in any changes to the capability of the existing system. In time, with increased traffic volumes and no action, this strategy would result in severe deterioration in road and traffic conditions.

Strategies G and D (outer now, abandon inner; and outer now, reserve inner) were both considered to represent an improvement over Strategy I in terms of meeting the objective. Both strategies would provide a new outer route for through traffic which would be built to National Highway standards providing an improvement over the existing highway conditions by attracting through traffic. Strategy D, however was considered to be better than Strategy G since it provided for the reservation of the inner route which would allow its construction at some point in the future and would allow a second river crossing between Albury and Wodonga, the need for which is required in the immediate future with the Lincoln Causeway already approaching capacity.

Strategies C and B (inner now, abandon outer; and inner now, reserve outer) were considered to best meet the objective. Both strategies would provide a new inner route which would cater for both through traffic and traffic between Albury and Wodonga. It would cater for both through traffic and traffic between Albury and Wodonga, i.e., it would be built to National Highway standards, and which would be used by significantly greater volumes of traffic then strategies G and D. Benefits would therefore be provided for more road users and a greater overall contribution to the improvement of existing road and traffic conditions would be made by strategies C and B. Both strategies adequately cater for short- and medium-term traffic demand and strategies C and B were therefore assessed to meet the objective equally.

Objective: to improve interstate linkages

Strategy I (abandon inner and outer routes) was assessed as least satisfying the objective. It would retain the current situation and because there would be no road improvements, this strategy would result in interstate linkages deteriorating.

Strategies C and B (inner now, abandon outer; and inner now, reserve outer) would satisfy the objective considerably better than strategy I. Both strategies would provide a new route that would be built to National Highway standards, representing a considerable improvement in interstate linkages. No difference exists between these strategies in how they meet the objective in the short- to medium-term.

Strategies G and D (outer now, abandon inner; and outer now, reserve inner) would also provide a new route for through traffic which would be built to National Highway standards. Since through traffic could use the route without having to share it with intercity traffic, these strategies were assessed as best meeting the objective. There would be no short- to medium-term difference in the way these strategies meet the objective.

Objective: to improve intercity linkages

Strategy I (abandon inner and outer routes) would retain the current situation. It was assessed as least satisfying the objective since, without any improvements, existing intercity linkages would deteriorate and congestion levels across the Lincoln Causeway would soon be intolerable for many hours each day.

Strategies G and D (outer now, abandon inner; and outer now, reserve inner) satisfy the objective only marginally better than strategy I. While through traffic would use the outer route, thereby providing some additional spare capacity on the existing highway, the volume of traffic which is potentially divertible to the outer route is less than the predicted traffic growth on the Lincoln Causeway over a two-year period. Accordingly, with the outer route constructed there would only be a marginal improvement in intercity linkages for a period of less than two years. Thereafter, existing intercity linkages would deteriorate. In the short- to medium-term time frame, there would be no difference between these strategies in terms of improving intercity linkages.

Strategies C and B (inner now, abandon outer; and inner now, reserve outer) were both considered to meet this objective well. Both strategies would provide a second river crossing and would represent a significant improvement in intercity linkages. In the short to medium time frame, there would be no difference in the way these strategies meet the objective.

30.5.2 Physical Environment

Objective: to minimise adverse impacts on the environment

Strategy I (abandon inner and outer routes) with no additional construction involved would result in no initial impact on the natural environment although traffic volume issues such as air quality and noise are likely to have greater impact on the existing highway in the future than they do at present. The adverse impacts that presently exist on the existing highway would therefore be exacerbated with little opportunity available for the implementation of safeguards which can be incorporated into the construction of a new route. This option was therefore evaluated as least satisfying the objective.

Each of the remaining strategies (B, C, D and G) would involve the construction of new roads and would therefore result in impacts on the physical environment. These impacts are discussed elsewhere in this EIS/EES together with safeguards considered necessary to mitigate those impacts.

There was very little difference assessed between strategies B and D (inner now, reserve outer; and outer now, reserve inner) in terms of meeting the objective. In the long term, both are likely to result in a similar level of impact but in the short term, strategy B may have slightly less impact. Since construction of the outer route (strategy D) would not alleviate most of the existing problems of local traffic congestion, it is likely that at least part of the inner route would also be required as part of a short-term solution. Strategy D would not therefore meet the objective quite as well as strategy B in the short term since construction of the inner route would not require construction of the outer route to resolve traffic issues in the short term.

Strategies C and G (inner now, abandon outer and outer now, abandon inner) satisfy the objective better than strategies B and D (inner now, reserve outer and outer now, reserve inner) since they would involve less construction of new roads with consequent reduced impact on the environment. Strategy C has been assessed as being marginally better than strategy G in terms of minimising adverse impacts since much of the route has already been impacted by urbanisation in one form or another. While much of the outer route has been modified for agricultural/rural activities, the extent of modification is not as substantial as that which has occurred on the inner route.

Objective: to safeguard and enhance environmental amenity where possible

Strategy I (abandon inner and outer routes), is the 'Do Nothing' option and was evaluated as not meeting the objective as well as the other four strategies. The strategy does not contribute to the enhancement of environmental amenity and by doing nothing, there would be no safeguards introduced. As discussed previously, the 'Do Nothing' strategy would not afford the opportunity to introduce mitigating measures that would ameliorate increasing environmental impacts likely to result from increased traffic volumes nor would it facilitate measures aimed at improving the existing environmental amenity.

Strategy G (outer now, abandon inner) would provide for a new highway route but would cater for the lowest volumes of traffic of the remaining four strategies. This would mean that there would be little change to the existing situation within Albury Wodonga and consequently it represents the least opportunity of safeguarding and enhancing environmental amenity offered by these four strategies. While meeting the objective better than strategy I, this strategy does not therefore meet the objective as well as strategies B, C or D.

Ultimately, both strategies B and D (inner now, reserve outer; outer now, reserve inner) are likely to meet the objective in a similar manner. The time difference involved between the construction of one of the routes and subsequent construction of the second route would mean that strategy D would provide less opportunity for enhancement of environmental amenity than strategy B until the second phase of these strategies is implemented (in the long term) since the predicted volumes of traffic utilising the outer route rather than the existing highway are much less than those predicted for the inner route. Consequently, the same opportunity does not exist to provide greater enhancement of existing environmental amenity from the commencement of operation of the new highway. In the short term therefore, strategy D would not meet the objective any better than strategy G. Strategy B was assessed as being superior to strategy D owing to its ability to provide a second river crossing in the short to medium term.

Strategy C (inner now, abandon outer) would meet the objective as well as strategy B in the short to medium term, providing similar benefits as a result of similar levels of traffic utilising the new highway. Strategy B incorporates provisions for through traffic to use an alternative (outer) route rather than the inner route. In view of the potential difference in time between the construction of both routes, the manner in which they (strategies B and C) satisfy the objective in the short to medium term is considered to be similar.

Objective: to contribute to ESD

Strategy I makes the least contribution to ecologically sustainable development (ESD) since it maintains the existing situation which embodies many features which do not contribute to ESD. As an example, it does not make good use of existing resources with traffic congestion increasing the use of fossil fuels per vehicle kilometre. Additionally, it does not provide for the enhancement of quality of life in Albury Wodonga.

All other strategies contribute to ESD to varying degrees.

Strategy G (outer now, abandon inner) and strategy D (outer now, reserve inner) would involve the use of considerable road building resources and agricultural lands while at the same time providing relatively low benefits (by comparison to strategy B and C) in terms of traffic that would utilise the new route. The predicted low volumes of usage for the outer route would result in continued traffic congestion associated with the existing highway and consequent relatively higher levels of consumption of fossil fuel resources, as well as reduced opportunities for enhancing the total community's quality of life. While therefore meeting the objective better than strategy I, strategies G and D do not meet the objective as well as strategies B and C. In the short term there is no difference between strategies G and D.

Strategies B and C (inner now, reserve outer; and inner now, abandon outer) provide greater benefits than strategies G, D and I. By providing a National Highway route which would be better utilised from the commencement of operation, they would offer immediate reductions in traffic congestion on the existing highway with the level of reduction being much greater than would occur with strategy G or in the short term with strategy D. Strategy B does not, however, meet the objective quite as well as strategy C. The subsequent construction of the outer route would involve the use of additional road building resources and agricultural lands, but this would not occur in the short- to medium-term. The reservation of land for the outer route may, however, result in some loss of resources (agricultural land) in the short term.

Strategy C therefore meets the objective better than the other strategies since it provides the greatest benefits for the least use of resources and also provides a significant opportunity to enhance existing environmental amenity.

30.5.3 Social

Objective: to minimise adverse impacts on the community

The assessment of impacts contained in this EIS/EES concludes that appropriate mitigating measures and safeguards can be introduced to minimise impacts associated with both the inner and outer routes, e.g. noise. Other potential impacts that could affect the community are severance and air quality.

Strategy I (abandon inner and outer) would result in the retention of the existing highway as the only highway route. The current situation already results in community severance, and increasing volumes of traffic would only exacerbate the existing noise and air pollution situation. This strategy was therefore considered to least satisfy the objective.

Strategy G (outer now, abandon inner) would provide an improvement to the existing situation by catering for through traffic on the outer route. The low volumes of traffic that would use the outer route, however, would result in any improvement on the existing highway being only marginal. In addition, construction of the outer route would result in the severance of a number of rural and rural residential properties between Mullengandra and Klings Hill. It therefore would cause community dislocation particularly where there are existing small rural holdings and would do nothing to improve impacts (particularly severance) through the urban areas which would continue to be affected by the existing highway and its associated impacts.

Strategy D (outer now, reserve inner) would ultimately provide for a reduction in the existing impacts associated with the existing highway. In the short- to medium-term, however, it would only facilitate future construction of a second river crossing between Albury and Wodonga which would not immediately alleviate some of the restricted capacity impacts associated with the existing highway. Consequently, this strategy was considered to meet the objective better than strategy G.

Strategy B (inner now, reserve outer) provides a substantially greater opportunity than strategies G and D to minimise community impacts from the commencement of operations. Building the inner route in the short-term would provide similar benefits to strategy C. The impact on the community along the outer route would be substantially reduced by reservation of the outer route but some impact would be ongoing especially where purchase of lands by the road authorities rendered properties unviable. Existing residents may seek to relocate away from the area as a consequence of their property (or part of it) being acquired and this could further impact on the community. Strategy B was therefore assessed as meeting the objective better than strategy D but not as well as strategy C.

Strategy C (inner now, abandon outer) would minimise landuse impacts since the majority of the southern part of the route has previously been reserved and is generally vacant. In addition, the replacement of four railway level crossings with road overpasses in the short term would improve the existing situation with respect to community severance occasioned by the main southern railway and the existing highway. Some changes in access patterns could be expected to occur but the provision of grade separated road crossings over both the inner route and the railway, and the provision of a pedestrian overbridge at Dean Street would minimise these impacts. The abandonment of the outer route would also eliminate potential community impacts in the vicinity of that route associated with the construction and operation of the new highway route. This strategy was therefore assessed as meeting the objective better than the others.

Objective: to improve regional amenity

Strategy I (abandon inner and outer) was evaluated as least satisfying the objective since each of the other strategies would result in some reduction in traffic volumes along the existing highway, albeit to differing levels, and would therefore provide improvements in respect of regional amenity.

Strategy G (outer now, abandon inner) would meet the objective marginally better since through traffic would be able to use the outer route. The low volumes of traffic predicted on the outer route and the consequent continued use of the existing highway by substantial volumes of traffic would not, however, result in a significant improvement to regional amenity.

Strategy D (outer now, reserve inner) would satisfy the objective better than strategy G because reservation of the inner route would facilitate construction of a second river crossing between Albury and Wodonga which will be required in the short term.

Strategy C (inner now, abandon outer) and strategy B (inner now, reserve outer) satisfy the objective better than strategies D, G or I since they would have an immediate (short-term) impact on improving regional amenity in respect of a large volume of traffic. There would be little short- to medium-term difference between these strategies in the way they satisfy the objective.

Objective: to improve road safety

Strategy I (abandon inner and outer) was assessed as least satisfying the objective since, by maintaining the status quo, in terms of road configuration/alignment and with increasing traffic levels on the existing highway, accident rates would be expected to rise. In addition, by not offering improvements in traffic conditions it would not contribute to any reduction in the likelihood of spillages occurring from dangerous or hazardous cargoes. This strategy also fails to provide any opportunity to minimise or reduce the existing level of conflicting traffic movements.

Strategy G (outer now, abandon inner) meets the objective better than strategy I since it provides an alternative route for through traffic. The low volumes of traffic predicted would, however, result in the majority of traffic continuing to use the existing highway with the resultant increases in accident potential. The hazardous goods vehicle survey undertaken for this study indicated that, even with through traffic using the outer route, some 54% of vehicles carrying hazardous goods would still need to use the existing highway based on their origin or destination. Similarly, reductions in conflicting traffic movements would be limited to the relatively low volume of through traffic with a substantial proportion of the existing traffic not experiencing any reduction in conflicting traffic movements. Accordingly, strategy G does not satisfy the objective as well as strategies B, C or D.

Strategy D (outer now, reserve inner) would satisfy the objective better than strategy G only because reservation of the inner route would allow the construction of a second river crossing between Albury and Wodonga, the short-term need for which has already been identified.

Strategy C (inner now, abandon outer), and strategy B (inner now, reserve outer) satisfy the objective better than strategy D since they provide immediate improvements in road safety by catering for both through traffic and the large volume of local traffic between Albury and Wodonga. They also provide for a significant improvement in road safety through the replacement of four railway level crossings with road overpasses, and substantially reduce the potential for large numbers of conflicting traffic movements by utilising grade separated intersections and eliminating direct access to the new route. No differences were identified in the way these strategies meet the objective in the short to medium term and they were assessed as meeting the objective equally well.

Objective: to complement urban development strategies

Strategy G (outer now, abandon inner) and Strategy I (abandon inner and outer) were evaluated as least satisfying the objective. The location of the inner route within the urban areas of Albury and Wodonga has already been defined by zoning and is incorporated into the relevant planning controls. Urban planning and development in Albury and Wodonga has, since 1970s, been predicated on the construction of the inner route generally in its present location. Accordingly, urban development strategies have been based on this and an abandonment of the route would require a major revision of these strategies.

Strategy D (outer now, reserve inner) would retain the inner route reservation and is therefore consistent with urban development strategies. It does not, however, meet the objective as well as strategies C and B since construction of the outer route in the short to medium term does not resolve traffic problems on the existing highway. Urban development strategies developed since the 1970s have envisaged the construction of an inner route prior to the end of this century and the adoption of strategy D would not complement this.

Strategies B and C (inner now, reserve outer; and inner now, abandon outer) best satisfy the objective as they are complementary to existing urban development strategies. Each strategy meets the objective equally.

30.5.4 Economic

Objective: to achieve a cost effective solution

Maximising cost effectiveness can be expressed as achieving the greatest economic benefit at least economic cost. Benefit cost ratios for the project have been discussed in Chapter 10 and show that, with a 7% discount rate, the inner route has a BCR of 2.2. With the same discount rate, the outer route has a BCR of 1.0 which would increase to 1.4 if it was constructed as a two-lane road and it was assumed that all benefits remained the same. It is, however, clearly incorrect to assume that a two-lane road would provide the same benefits as a four-lane road and the actual BCR would be expected to be less than 1.4.

Strategy I (abandon inner and outer) does not involve the undertaking of any works. Since increasing volumes of traffic would result in increasing congestion and a deteriorating situation with respect to road user costs, it is not considered to be a cost effective solution and has therefore been evaluated as least satisfying the objective.

Strategy D (outer now, inner later) would satisfy the objective slightly better than strategy I. It also incurs the cost, however, of land acquisition for the inner route. If future construction of the inner route did not occur within the short- to medium-term time frame, this strategy would not be as cost effective as strategy G.

Strategy G (outer now, abandon inner) is marginally better at satisfying the objective particularly if the disadvantages of a two-lane road are set aside and the BCR of 1.4 is adopted.

Strategy B (inner now, reserve outer) by virtue of the construction of the inner route first, has a higher BCR than strategy G and therefore meets the objective better than strategies I, D and G. By including the cost of land acquisition for the outer route, it is not as cost effective as strategy C.

Strategy C has the highest BCR of the strategies and is therefore the strategy which best satisfies the objective.

Objective: to reduce total travel costs and travel time

Strategy I (abandon inner and outer), by maintaining the existing situation would result in increased congestion and significant increases in total travel costs or travel time. Accordingly, this strategy was considered to least satisfy the objective.

In the short term, Strategies G and D (outer now, abandon inner; and outer now, reserve inner) would provide savings in both travel costs and travel time but only in respect of a relatively low proportion of traffic. Savings in road user costs and accident costs (four-lane road) are substantially below the savings for strategies B and C. In the short-term, these strategies were assessed to meet the objective equally well and, while better than strategy I, do not satisfy the objective as well as strategies C and B.

Ultimately, strategies B and D (inner now, reserve outer; and outer now, reserve inner) would have similar annual cost savings. In the short term, however, strategy D would have similar cost savings to strategy G and would only offer greater savings if the inner route were subsequently constructed. Strategy D was therefore considered to meet the objective as equally well as strategy G, whereas strategy B would offer significantly greater savings from the commencement of operations and therefore satisfies the objective better than strategy D.

Strategy C (inner now, abandon outer) and strategy B (inner now, reserve outer), by catering for larger volumes of traffic in the short- to medium-term, offer substantial and more immediate savings in road user costs and accident costs. Consequently, they best satisfy the objective and were assessed as doing so equally well in the short- to medium-term.

Objective: to facilitate commercial activity

Each of the strategies would facilitate commercial activity to varying degrees.

Strategy I (abandon inner and outer) does not satisfy the objective as well as the other strategies since, by maintaining the existing situation, it also maintains many of the inefficiencies and costs associated with congestion along the existing highway.

Strategy G (outer now, abandon inner) would provide only marginal improvement to facilitating commercial activity in Albury Wodonga. On a broader scale, regional and interstate commercial activity would also benefit only marginally from this strategy owing to the relatively low volumes of traffic involved. Strategy G was therefore assessed as representing only a slight improvement over strategy I.

Strategy D (outer now, reserve inner) would offer no greater benefits than strategy G in the short- to medium-term, and, other than the opportunity for future long-term improvements, was assessed as meeting the objective as well as strategy G.

Strategy C (inner now, abandon outer) caters for substantial volumes of traffic and, by offering improved travel conditions to a larger number of vehicles, would result in greater satisfaction of the objective in local, regional and interstate terms than either strategies D or G. Strategy B (inner now, reserve outer) would offer the same level of benefits as strategy C in the short- to medium-term and satisfies the objective equally well.

Chapter 31
Comparative Option Analysis Summary

This chapter summarises the results of the strategy evaluation undertaken in Chapter 30 in tabulated form. Each key factor is discussed.

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CHAPTER 31
COMPARATIVE OPTION ANALYSIS SUMMARY

31.1 Short- to Medium-Term Needs
31.2 Long-Term Needs

31 COMPARATIVE OPTION ANALYSIS SUMMARY

In Chapter 30, the project objectives were discussed in relation to short- to medium-term needs. The results of the strategy evaluation have been summarised for the purpose of comparing the various options embodied in the strategies and is presented below and in Table 31.1.

31.1 Short- to Medium-Term Needs

31.1.1 Transport

Strategy I was evaluated as least satisfying the transport objective. Strategies D and G both represented an improvement over strategy I and strategy D was considered to be better than strategy G. Strategy C and strategy B were assessed as meeting the objectives equally well in the short to medium term, with both representing the best means of satisfying the objectives.

31.1.2 Physical Environment

Overall, strategy I was assessed as least satisfying the objectives while strategies D and G followed by strategy B were each marginally better in the manner that they met the objectives. Strategy C was evaluated to be the strategy which best satisfied the physical environment objectives in the short to medium term.

31.1.3 Social

Strategy I was considered to least satisfy the social objectives. Strategy G was assessed to meet the objectives marginally better and strategy D represented a further improvement in terms of meeting the objectives. Strategies C and B were evaluated as best satisfying the objectives with strategy C meeting the objectives marginally better.

31.1.4 Economic

The strategy which least satisfied the economic objectives was strategy I. Strategy G and strategy D were assessed as better satisfying the objectives to an equal extent. Strategy B was assessed as being better in terms of satisfying the economic objectives while strategy C was evaluated as best satisfying the objectives.

31.2 Long-Term Needs

As shown in Table 31.1, strategies B and C best met the short- and medium-term needs of the project when assessed against the project objectives. Both these strategies include the building of the inner route in the short to medium term, while strategy B incorporates the reservation of the outer route and strategy C abandonment of the outer route reservation.

Table 31.1 -- Summarised Comparison Matrix - (Short- to Medium-Term Needs)

Key Factor	Strategies				
	'B' Inner Now Reserve Outer	'C' Inner Now Abandon Outer	'D' Outer Now Reserve Inner	'G' Outer Now Abandon Inner	'I' Abandon Inner and Outer
TRANSPORT					
PHYSICAL ENVIRONMENT					
SOCIAL					
ECONOMIC					

Note: best satisfies objectives ← → least satisfies objectives

Apart from satisfying short- to medium-term needs, both strategies B and C provide solutions for future long-terms needs when identified. Two base options provide for longer term needs if the inner route reaches the point where additional system capacity is required. These options are to build the outer route or expand the inner route by building additional traffic lanes. By adopting strategy B (inner now, reserve outer), both future options are available. By adopting strategy C (inner now, abandon outer), the inner route widening options available.

The results of the assessment of the respective long-term merits and impacts of these two strategies, if undertaken now, will be different to an assessment undertaken in (say) thirty to forty years time, when the need to expand the system may be raised. Technological advances of the past twenty years, when projected fifty years into the future, suggest that operating conditions, environmental issues and transportation matters cannot confidently be predicted from current trends.

Possible changes in conditions could include:

- form and nature of development in Albury Wodonga
- population/manufacturing shifts in non-metropolitan areas
- environmental policies/ESD principles
- transport policy (mode shift/tax arrangements)
- road traffic operating costs
- the world economy
- quality of life expectations.

Based on available information, this comparative analysis shows that both strategies (B and C) would be acceptable in meeting short- to medium-term needs and may also be equally acceptable in meeting long-term needs. It remains for the government to form a strategic assessment of reserving or abandoning the outer route to assist in meeting long-term needs.

It is recognised that abandoning or reserving the outer route is a major decision and is one in which the community should be involved. This EIS/EES has been prepared on the basis of putting the relevant issues to the community and encouraging its views in order to assist in the determination process as set out in Chapter 1. The document sets out the identified issues for consideration and these, together with any others raised during the exhibition period, will be considered during the panel hearing and the assessment process. The outcomes of this process will then be made available to the relevant decision makers before a determination on the project is made.

PART H
ENVIRONMENTAL MANAGEMENT

Chapter 32
Monitoring and Management

Chapter 32 addresses the necessary characteristics of an Environmental Management Plan (EMP), which outlines the commitment of the RTA and VicRoads to the safeguard measures mentioned in this EIS/EES. It also addresses issues necessary to be monitored to quantify the effectiveness of the EMP.

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CHAPTER 32

MONITORING AND MANAGEMENT

32 MONITORING AND MANAGEMENT

32.1 Principles

A number of environmental monitoring and management tools have been identified in the preparation of this EIS/EES. If the project proceeds, implementation of these measures would be necessary to ensure that the project minimises impacts on the physical, social and economic environments.

The construction and operation of a new National Highway through the study area would be a major undertaking. Without appropriate environmental management measures being incorporated into the detailed design of the proposal and the contractual arrangements associated with its construction and maintenance, there would be the potential for adverse impacts on the environment to occur. Adoption of an appropriate monitoring program and Environmental Management Plan (EMP) would therefore be an important component of the proposal which outlines the commitment of RTA and VicRoads to the safeguard measures outlined in this EIS/EES. If the project proceeds, the RTA and VicRoads would undertake the preparation of an EMP after the assessment process and the EMP would become part of the pre-construction documentation.

32.2 Environmental Management Plan

An EMP is a procedural document which outlines the environmental goals of the project, the safeguard measures to be implemented, the timing of implementation in relation to the progress of the project, responsibilities for implementation and management, and a review process.

The EMP addresses the pre-construction, construction and operational phases of the project and is prepared following assessment of the project. It would provide a working tool to be used during the detailed design of the proposal and would form the basis for environmental specifications in any contractual arrangements between the proponents and constructing parties.

The EMP would include:

- establishment of environmental goals and objectives;
- conditions of project approval;
- list of actions, timing and responsibilities;
- supervision protocols fully identifying areas of responsibility for environmental management of the project;
- statutory requirements (licences and approvals required);

- a structured reporting system detailing all relevant matters on a regular basis;
- procedures and forms for documentation and reporting of issues;
- standard specifications incorporating environmental safeguards (e.g., erosion and sedimentation, clearing and grubbing);
- training of personnel (proponent and contractor) in environmental awareness and Best Practice Environmental Management Systems;
- guidelines for emergencies, contact names and corrective actions for non-conformance and notifications to appropriate authorities and affected parties;
- calibration and measuring of testing equipment;
- process surveillance and auditing procedures;
- review procedures and protocols for modification of the EMP;
- complaint handling procedure;
- site management and control procedures;
- monitoring procedures;
- quality assurance procedures.

The EMP would also be made available to local councils, government departments, statutory authorities, the community and all other interested organisations and individuals.

An outline of the structure and contents of an EMP is included in Appendix L.

32.3 Monitoring Program

Environmental monitoring is the activity of collecting and interpreting data to provide quantification of the effectiveness of the EMP. It allows the appropriate type and quantity of information to be collected for analysis.

An ongoing program also enables auditing of the safeguard measures to ensure they achieve their objectives are effective and to facilitate modification where necessary. The responsibilities for conducting monitoring would be determined by the RTA and VicRoads in consultation with the contractor (see Table 33.1).

The monitoring program would address the following issues:

- noise and vibration
- air quality
- water quality
- visual quality
- erosion and sedimentation
- flood control management
- archaeology and heritage
- vegetation management
- road and traffic management
- groundwater management.

The monitoring program would provide a systematic and objective process for collection and analysis of information.

Issues to be considered in the monitoring program include:

- background data
- sampling procedures
- reporting and data interpretation
- recommendations
- laboratory and chain of custody procedures
- statutory limits.

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Chapter 33
Summary of Safeguard Measures

Chapter 33 lists a number of environmental safeguards/mitigating measures to reduce any potential impacts which may be generated by the proposal.

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CHAPTER 33
SUMMARY OF SAFEGUARD MEASURES

33 SUMMARY OF SAFEGUARD MEASURES

A number of environmental safeguards/mitigating measures to reduce any potential environmental impacts which may be generated by the proposal have been detailed in the various subject chapters.

These measures would be implemented during the construction and operational phases of the project. Table 33.1 details safeguard measures, sets up priorities for implementation, and lists the authorities responsible for ensuring that these mitigative procedures are carried out. This is the first step in the preparation of an EMP which forms the link between environmental assessment and construction operations. The EMP would included a general environmental management component such as RTA and VicRoads corporate environmental policies, designation of environmental responsibilities and general environmental procedures with respect to reporting, complaint investigation, operator training, engineering response procedures and so on.

An outline of a draft EMP is given in Appendix L.

Table 33.1 identifies a priority for implementation in respect of each of the safeguards.

Table 33.1 -- Safeguard and Mitigation Measures

Issue	Safeguards	Implementation Phase (1)	Responsibility
ENVIRONMENTAL MANAGEMENT Environmental Management and Monitoring	□ Prepare and implement an EMP	1	RTA/VicRoads
GEOTECHNICAL Instability of Fill Slopes	□ Ensure the following are installed: foundation preparation and stabilisation, reinforced fill, gentle slope drainage and control of surface runoff, establish protective vegetation and provide artificial slope protection.	1	RTA/VicRoads
Instability of Cut Slopes	□ Ensure the following are installed: drainage and control of surface runoff, as gentle a slope as possible, establish protective vegetation, put in place artificial slope protection and rock anchors/rockbolts/dowelling/shotcreting.	1	RTA/VicRoads
Erosion of Gullies and Altered Surface	□ Energy dissipaters in gullies such as rocks or concrete blocks, etc	1	RTA/VicRoads
Drainage Conditions	□ Lining gullies with concrete rock or gabions in areas of springs and high watertables. □ Frequent use of culverts under fill in existing streams to minimise concentration of flows and alterations to drainage patterns.		
Siltation	□ Road drainage in areas of cut and fill designed to minimise erosion, such as lining, to reduce the water flow and prevent further erosion and silt traps to prevent material entering existing waterways.	1, 2, 3	RTA/VicRoads
Deterioration of Road Pavements	□ Subsurface drainage to draw the watertable below the road base. □ Relief of aquifer pressure using wells or sumps.	1	RTA/VicRoads

(Table continued over)

(1) = Implementation Phase
1 = Pre construction
2 = Construction
3 = Post Construction

Table 33.1 -- Continued

Issue	Safeguards	Implementation Phase (1)	Responsibility
GEOTECHNICAL Cont'd			
Bridging Foundations	□ Provide: piling, foundation preparation and stabilisation, reinforced fill, gentle slope, drainage and control of surface runoff, establish protective vegetation and artificial slope protection.	1	RTA/VicRoads
Instability of Foliated and Faulted Areas	□ Provide: foundation preparation and stabilisation, drainage and control of surface runoff, flatter slope, rock anchors/rockbolts/ dowelling/shotcreting, and replacement of weaker material.	1	RTA/VicRoads
Sterilisation of Mineral Resources	□ Remove and stockpile	1	RTA/VicRoads
Salinity and High Ground Water	□ Adequate drainage systems. □ Appropriate vegetation planting.	1	RTA/VicRoads
Earthquake Hazards	□ Detailed design of cuts, fills and foundations to include consideration of potential seismic activity.	1	RTA/VicRoads
HYDROLOGY			
East Albury Drain	□ Provide a concrete lined channel and scour protection.	1, 2, 3	RTA
	□ Ensure that culverts or bridges do not reduce the capacity of the open lined channel located downstream of Jellbart Street.	1	RTA
	□ Install energy dissipater at culvert outlets to reduce velocities.	1, 2, 3	RTA

(Table continued over)

(1) = Implementation Phase
1 = Preconstruction
2 = Construction
3 = Post Construction

Table 33.1 -- Continued

Issue	Safeguards	Implementation Phase (1)	Responsibility
WATER QUALITY Runoff and Quality	□ Prepare and implement an Erosion and Sediment Control Plan. □ Install vegetative systems, including grassed channels and buffer strips. □ Provide detention basins and wetlands where necessary.	1, 2, 3 1 1, 2, 3	RTA/VicRoads RTA/VicRoads RTA/VicRoads
SOCIO-ECONOMICS Land Severance	□ Provide underpasses. □ Purchase worst affected properties.	1 1, 2	RTA/VicRoads RTA/VicRoads
Loss of Agricultural Production/ Viability	□ Resumption and appropriate compensation.	1, 2	RTA/VicRoads
AIR QUALITY Dust	□ Regularly water access roads and earthworks.	2	Contractor
Burning	□ Ensure that burning of cleared vegetation is not permitted.	2	Contractor
NOISE AND VIBRATION Noise and Vibration	□ Noise and Vibration Management Plan (incorporating items raised in Section 12.8)	1, 2	Contractor
Traffic Noise	□ Open graded asphalt (where required)	1, 2	RTA/VicRoads/ Contractor
	□ Provide noise barriers (where required)	1, 2	RTA/VicRoads/ Contractor

(Table continued over)

(1) = Implementation Phase
1 = Preconstruction
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3 = Post Construction

Table 33.1 -- Continued

Issue	Safeguards	Implementation Phase (1)	Responsibility
NOISE AND VIBRATION Cont'd			
Construction Noise	□ Noise monitoring program	2, 3	Contractor
	□ Liaison with residents	2	Contractor
	□ Use of silence equipment	2	Contractor
	□ Equipment operation and maintenance	2	Contractor
	□ Equipment and orientation	2	Contractor
	□ Vehicle movements	2	Contractor
Vibratory Roller	□ Vibration monitoring if closer than 12 m from building	2	Contractor
FLORA AND FAUNA			
Vegetation Clearing	□ Limit the clearing of native vegetation wherever it occurs along the proposed routes to the minimum required for construction and safety. Where possible, established trees and native shrub understoreys would be left, with clearing widths for the roadways in these areas being reduced to the minimum possible.		

(Table continued over)

(1) = Implementation Phase
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Table 33.1 -- Continued

Issue	Safeguards	Implementation Phase (1)	Responsibility
FLORA AND FAUNA Cont'd			
	□ Where broader areas are required for clearing (e.g., for plant sites or works offices), these would be located in areas of grassland or already cleared lands. Where trees require felling, consideration would be given to their retention on roadside batters to provide habitat for reptiles, and to recreate the habitat which appears of relevance to the bush stone curlew.	2	Contractor
Replanting Exposed Surfaces	□ At completion of construction, the landscape strategy would be undertaken (removing weeds and judicious replanting of rare or regionally locally occurring native species e.g., mixed box woodland or river red gum woodland types).	2,3	RTA/VicRoads
Erosion Control	□ Appropriate and comprehensive management of exposed soil surfaces and stockpiles would be required during construction of the roadways to minimise or prevent sediment discharge into adjacent waterways, wetlands and fauna habitat.	1, 2	Contractor
	□ The installation of temporary and permanent erosion control structures would be required prior to soil disturbance to minimise erosion and sedimentation of adjacent waterways, wetlands and maintain water quality for downstream users.	1, 2, 3	RTA/VicRoads/ Contractor
Bridging	□ The bridging of watercourses would be designed and constructed to enable the movement of native fauna along riverbanks.	1	RTA/VicRoads

(Table continued over)

(1) = Implementation Phase
1 = Preconstruction
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Table 33.1 -- Continued

Issue	Safeguards	Implementation Phase (1)	Responsibility
RIVERINE HABITAT			
Murray River Floodplain	□ On the Murray River floodplain, special attention would be paid both to the siting of the proposed roadways and to the construction methods used at each site. Particular attention would be paid to avoiding, wherever possible, any impacts on billabongs that are of potential significance to native fauna.	1	RTA/VicRoads
Road Reserve	□ Roadside batters and road reserve areas which are to be rehabilitated would provide supplementary habitat for particular fauna.	1, 2, 3	RTA/VicRoads/ Contractor
LANDUSE			
Land Acquisition	□ Prepare a land acquisition program under the provisions of the Land Acquisition (Just Terms Compensation) Act 1991.	1	RTA/VicRoads
Negotiations and Compensation	□ Negotiate with local landowners to determine a fair level of compensation for the impact of the proposed roadworks on their properties.	2	RTA/VicRoads
Landscaping	□ Implement landscape works to increase visual amenity in the vicinity of the road, nearby residences and the villages.	1, 2, 3	RTA/VicRoads/ Contractor
Local Access	□ Ensure that access is maintained to local properties from the local road network.	1, 2, 3	RTA/VicRoads/ Contractor/Councils

(Table continued over)

(1) = Implementation Phase
1 = Preconstruction
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Table 33.1 -- Continued

Issue	Safeguards	Implementation Phase (1)	Responsibility
LANDUSE Cont'd			
Access During Construction	□ Maintain 24 hour access to all properties during construction. Implement traffic management measures such as speed restrictions on approaches, precautionary signage, illuminated warning devices, manual traffic directives and temporary markers and barriers as required.	2	Contractor
Stock Underpasses and Yards	□ Provide stock underpasses for farms divided by the proposed road and threatening farm viability. Extra yards for stock would be provided if needed.	2	Contractor
ARCHAEOLOGY			
Subsurface Testing	□ Take into account the findings of further subsurface testing on those sites identified in Chapter 17.	1, 2	RTA/VicRoads
Salvage Relics	□ Salvage relics in consultation with the NPWS, Victorian Department of Aboriginal Affairs and appropriate Land Councils.	1, 2	RTA/VicRoads
Destroy Relics	□ Seek permission from the NPWS and the Victorian Department of Aboriginal Affairs to 'destroy' and 'destroy with salvage', relics.	1,2	RTA/VicRoads
Potential Sites	□ Five areas have been identified as potential archaeological sites. Further investigation (including subsurface testing) is being undertaken, and these results need to be taken into consideration prior to construction.	1	RTA/VicRoads

(Table continued over)

(1) = Implementation Phase
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Table 33.1 -- Continued

Issue	Safeguards	Implementation Phase (1)	Responsibility
HERITAGE Agricultural Implement	□ The object identified 400 m east of Olympic Way would be relocated before construction.	1	RTA
'Willow Grove'	□ The route does not directly affect the homestead, but care would be taken during construction not to affect the site.	2	RTA/Contractor
'Ring-a-Rah'	□ Take into consideration the results of test excavations being undertaken on the stockyard site just north of the Murray River on the outer route.	1	RTA
Plough	□ The remains of a plough - 650 m north of Thurgoona Drive would be relocated.	1	RTA
Murray River	□ The Murray River landscape is listed by the National Trust and road designs would therefore attempt to minimise hydrological or other impacts.	1	RTA/VicRoads
Murray River Railway Bridge	□ The proposal for the inner route does not impinge on the Bridge, but care would be taken during construction not to adversely affect the bridge.	2	RTA/VicRoads/ Contractor
'De Kerilleau'	□ 'De Kerilleau' is not directly affected by the proposal, but mitigation measures such as landscaping would be implemented.	2	VicRoads
'Cambourne'	□ Cambourne would be retained on its present site and access restored.	1, 2, 3	VicRoads

(Table continued over)

(1) = Implementation Phase
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Table 33.1 -- Continued

Issue	Safeguards	Implementation Phase (1)	Responsibility
HERITAGE Cont'd			
Hanel and Kenilworth Conservation Areas	□ Intrusion of roadworks into the Hanel and Kenilworth Street Conservation Areas would be avoided.	2	RTA
Railway Gatekeeper's Cottage	□ The inner route does not impinge on the railway gatekeeper's cottage in Dalinger Road, but care would be taken during construction not to adversely affect this building.	1, 2	RTA/ Contractor
Murray Valley Vineyard	□ The inner route does not impinge on the ruins of the Murray Valley Vineyard cellar in Dalinger Road, but care would be taken during construction not to adversely affect these ruins.	2	RTA/Contractor
Albury Rail Station Yard	□ The inner route does not impinge on Albury Railway Station Yard, but care would be taken during construction not to adversely affect these works.	2	RTA/Contractor
Broad Street	□ Mitigation measures to retain the breadth of Broad Street would be taken before construction.	1	RTA
VISUAL AND LANDSCAPING			
Landscape Strategy	□ Implement landscape strategy.	2	RTA/VicRoads
	□ Provide plantings in the vicinity of proposed interchanges to ameliorate any visual impacts on nearby residences.	1, 2, 3	RTA/VicRoads
	□ Provide trees at existing and proposed rest areas to offer shade and increase the amenity of these areas.	2	RTA/VicRoads

(Table continued over)

(1) = Implementation Phase
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Table 33.1 -- Continued

Issue	Safeguards	Implementation Phase (1)	Responsibility
VISUAL AND LANDSCAPING Cont'd Landscape Strategy Cont'd	□ Conserve existing vegetation where possible. Plant trees along the disturbed verge (particularly locally or regionally rare species) and protect new plantings with tree barriers.	2	RTA/VicRoads/ Contractor
	□ Rehabilitate disturbed areas from road construction and new road margins with local native trees, shrubs and ground cover species.	2,3	Contractor
	□ Screen compound sites and locate away from environmentally sensitive areas. Carefully site construction tracks to minimise disturbance of local areas and to reduce visual impact.	2	Contractor
	□ Develop a program of weed management and control to be implemented during the construction and landscaping phase and put into effect for at least twelve months after the completion of works.	2, 3	Contractor
	□ Incorporate areas of revegetation along the boundaries of stockpile areas for erosion and sedimentation control.	2	Contractor
	□ Use young, small and suitably hardened stock for landscaping works together with in situ seeding with native species.	2, 3	RTA/VicRoads/ Contractor
	□ Develop a maintenance program to ensure that all landscape treatments mature and achieve the desired effects.	2, 3	RTA/VicRoads
	□ Use seed bearing mulch for revegetation areas which could be obtained from local seed collection and chipping of felled trees.	1,2	Contractor

(Table continued over)

(1) = Implementation Phase
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Table 33.1 -- Continued

Issue	Safeguards	Implementation Phase (1)	Responsibility
VISUAL AND LANDSCAPING Cont'd Landscape Strategy Cont'd	□ Spread topsoil as close as possible to where the soil was originally stripped to ensure that the seed bank contained in the topsoil is compatible with surrounding vegetation communities.	2, 3	Contractor
	□ Monitor landscaped works both during and after construction, and at long-term intervals thereafter, to determine the performance of these works after implementation.	2, 3	RTA/VicRoads
	□ Stockpile surface litter in combination with the surface soil layer for later use with landscaping.	2	Contractor
	□ Mulch all planting areas with a suitable organic material.	2	Contractor
CONSTRUCTION SITE MANAGEMENT	□ Ensure activities on the construction site incorporate adequate management practices for the careful treatment of rubbish and waste materials, collection and removal of excess contaminants and liquids, provision of ablution and workshed facilities, to limit discharges into adjacent habitats and waterways.	1, 2	RTA/VicRoads/ Contractor
	□ Compound site would be located within the road reservation and be contained on cleared land away from sensitive vegetation areas, watercourses, residences, hospitals, schools and other noise sensitive locations.	2	RTA/VicRoads/ Contractor

(Table continued over)

(1) = Implementation Phase
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Table 33.1 -- Continued

Issue	Safeguards	Implementation Phase (1)	Responsibility
CONSTRUCTION SITE MANAGEMENT Cont'd	□ To enable work to be constructed while maintaining the flow of existing traffic, traffic would be switched between constructed portions of work using temporary connections between carriageways. Carriageways through the work would be used in a two-way configuration with appropriate speed regulation until each stage of work is complete.	2	RTA/VicRoads/ Contractor

(1) = Implementation Phase
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Chapter 34
Concluding Statement

This chapter provides a summary of individual impacts in respect of each route in tabulated form. It discusses the consequences of No Action or Deferral of the highway project and provides justification for the undertaking of the project.

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CHAPTER 34
CONCLUDING STATEMENT

34.1 Need for Improvements
34.2 Impact Assessment
34.3 Consequences of No Action or Deferral
34.4 Justification of the Project

34 CONCLUDING STATEMENT

This EIS/EES assesses the potential environmental impacts of the construction and operation of a new National Highway route within the Albury Wodonga region. Two routes have been assessed to fulfil this function and are referred to throughout this document as the inner route and the outer route.

It is not the purpose of this EIS/EES to identify which route should be built -- that decision rests solely with the Federal Minister for Transport.

The role of the EIS/EES is to provide unbiased information to the community and to the three governments (NSW/Victoria/Commonwealth) about both routes, which will allow an informed decision to be made.

34.1 Need for Improvements

The Hume Highway through Albury Wodonga needs to be upgraded as it is below National Highway standards, has a poor horizontal alignment, a relatively large heavy vehicle component, a poor safety record and a level of service which is approaching unacceptable conditions.

The direct benefits to road users of the project which also translate as benefits to the broader community include:

- improved National Highway route;
- a consistent design speed;
- improved surface conditions;
- divided carriageways;
- widening to four lanes for full length;
- improved level of service;
- reduced travel times;
- reduced vehicle operating costs;
- improved traffic safety;
- controlled access.

Other non-road user benefits of the project include benefits to trade and commerce, urban development and regional amenity.

34.2 Impact Assessment

The assessment of the possible effects of the proposal on the environment clearly show there would be minor and acceptable impacts with the nominated safeguards implemented and all necessary approvals and licences obtained. It is considered that the benefits of the proposal outweigh any adverse aspects and the project is justified on environmental, economic and social grounds.

A summary of individual impacts in respect of each route is provided in Table 34.1.

Table 34.1 -- Summary of Impacts

Factor	Inner Route	Outer Route
Traffic	□ Improved capacity because of grade separated interchanges and limited access to local road system. High capacity with grade separation. Existing network efficiency increased as current load is taken off existing roads. Provides capacity to cater for traffic growth in the existing and proposed release areas around Albury Wodonga.	□ Improved capacity because of grade separated interchanges and limited access to local road system. High capacity with grade separation. Minor improvements to the existing network efficiency as current load is lowered. Provides capacity to cater for traffic growth in the Jindera area.
	□ Travel time and operating cost savings for public and private commuters. Substantial travel time savings predominantly on route but local traffic would also benefit because of the diversion of traffic. Cyclists would benefit from the provision of a dedicated cycleway.	□ Travel time savings for public and private commuters not stopping in Albury or Wodonga. Minor travel time savings predominantly on route but local traffic would also receive minor benefits because of the diversion of some traffic.
	□ 30% of through vehicles (960) fully divertible to inner route.	□ 30% of through vehicles (960) fully divertible to outer route.
	□ Potential use by study area traffic (25,000 vehicles per day).	□ Potential use by 13% of study area traffic (3,200 vehicles per day) if services provided on outer route.
	□ Potential use by all commercial vehicles (3,100).	□ Potential use by 27% of commercial vehicles (840).
	□ No additional relief for the Lincoln Causeway would be required if the inner route is developed.	□ Additional relief is still required on the Lincoln Causeway if the outer route is developed.
	□ Annual roaduser cost savings (2021) $55 million.	□ Annual road user cost savings (2021) $26 million.

(Table continued over)

Table 34.1 -- Continued

Factor	Inner Route	Outer Route
Traffic Cont'd	□ Would provide good access to proposed bus-rail interchange at Albury Rail Station. Tour coaches would benefit from using the route as it would be congestion free, particularly during peak holiday periods.	
	□ Fewer road accidents because of better traffic flow and less traffic conflict points. Greater accident savings than outer route due to higher volumes of freeway traffic. Reduced risk to pedestrians and cyclists on local streets because of traffic diverting to new link.	□ Fewer road accidents because of better traffic flow and less traffic conflict points. Reduced risk to pedestrians and cyclists on local streets because of traffic diverting to new link.
	□ Lower risk because proposed link is safer than existing roads	□ Lower risk because proposed link is safer than existing roads.
Landform, Geology, Soils and Geotechnical	□ Overall less significant impact on the surrounding terrain because of the shorter river crossing, less steep grades and tendency to follow the existing highway.	□ A new route passing through more hills and over a longer length of floodplain, resulting in greater disturbance to the existing terrain.
	□ Potential impact because of earthworks and excavations in areas of highly erodable soils.	□ Potential impact because of earthworks and excavations in areas of highly erodable soils.
Hydrology and Flooding	□ In terms of the environmental impacts of the proposed route, provided the bridge crossings have a minimum waterway equal to or exceeding that for the existing culvert, and the abutment profile is maintained between the twin bridges, there is not expected to be any significant impact on either upstream flood levels or downstream scouring due to increased flow velocities.	□ In terms of the environmental impacts of the proposed route, provided the bridge crossings have a minimum waterway equal to or exceeding that for the existing culvert, and the abutment profile is maintained between the twin bridges, there is not expected to be any significant impact on either upstream flood levels or downstream scouring due to increased flow velocities.

(Table continued over)

Table 34.1 -- Continued

Factor	Inner Route	Outer Route
Water Quality	□ Provided that appropriately designed and maintained works are implemented, there is expected to be no appreciable impact on water quality during the construction phase and no increase in the sediment yield from catchments.	□ Provided that appropriately designed and maintained works are implemented, there is expected to be no appreciable impact on water quality during the construction phase and no increase in the sediment yield from catchments.
Socio-Economic	□ Land severance along the northern part of the inner route. Localised community severance, particularly in East Albury.	□ Land severance experienced all along the outer route. Localised community severance, particularly east and west of Jindera.
	□ Agricultural land acquisition cost of $250,000.	□ Agricultural land acquisition cost of $1.35 million.
	□ $31,000 per annum of lost agricultural production.	□ $100,000 per annum of lost agricultural production.
	□ Farm viability not considered a major issue.	□ Issue of farm viability quite strong.
	□ Inner route located close to existing highway. Negative impacts likely to be smaller than outer route.	□ Outer route located further from existing highway. Negative impacts likely to be greater than inner route.
	□ Construction cost $203 million.	□ Construction cost $263 million for a dual carriageway and $189 million for a single carriageway.
	□ Estimated road user benefits (2021) $183,083.	□ Estimated road user benefits (2021) $86,799.
	□ Benefit Cost Ratio 2.21.	□ Benefit Cost Ratio 1.01 (dual carriageway) and 1.40 (single carriageway)
Meteorology and Air Quality	□ Should result in minor reduction in emissions per vehicle.	□ Air quality benefits are marginal at best.

(Table continued over)

Table 34.1 -- Continued

Factor	Inner Route	Outer Route
Meteorology and Air Quality Cont'd	□ The difference between regional concentrations in carbon monoxide and nitrogen dioxide with the inner and outer route options would be small because there would be only minor changes in regional traffic patterns. There would be a much larger change (and overall reduction in concentration of these contaminants) due to the more stringent controls in vehicle emissions, offset to some extent by the increase in vehicles travelling in the region.	□ The difference between regional and concentrations in carbon monoxide and nitrogen dioxide with the inner and outer route options would be small because there would be only minor changes in regional traffic patterns. There would be a much larger change (and overall reduction in concentration of these contaminants) due to the more stringent controls in vehicle emissions, offset to some extent by the increase in vehicles travelling in the region.
	□ The reduction in the lead content of petrol over the next decade would virtually eliminate the problem of lead contamination due to vehicle emissions in the Albury Wodonga region.	□ The reduction in the lead content of petrol over the next decade would virtually eliminate the problem of lead contamination due to vehicle emissions in the Albury Wodonga region.
	□ Vehicles are reported to constitute 15% of the total emissions rate of particles, the additional vehicles on the two route options would have negligible effect on respirable particle concentrations in the region. Locally there would be a minor increase in particle concentrations but it is considered that the proposed limits for respirable particles would generally be met for both route options.	□ Vehicles are reported to constitute 15% of the total emission rate of particles, the additional vehicles on the two route options would have negligible effect on respirable particle concentrations in the region. Locally there would be a minor increase in particle concentrations but it is considered that the proposed limits for the respirable particles would generally be met for both route options.
	□ Dust during construction could be a short-term problem with the inner route for properties near the road construction.	□ Dust created during construction would not be expected to be a problem for the outer route, which crosses a rural area.

(Table continued over)

Table 34.1 -- Continued

Factor	Inner Route	Outer Route
Meteorology and Air Quality Cont'd	□ Overall, there is very little difference between the two routes in air quality terms.	□ Overall, there is very little difference between the two routes in air quality terms.
Noise and Vibration	□ The NSW RTA traffic noise level objectives would be exceeded in a number of areas, mainly in East and South Albury, so three noise barriers are required in NSW. □ In order to achieve VicRoads traffic noise objectives, noise barriers are required near Mill Street. □ More properties along the inner route would experience noise levels in excess of the recommended design limit during construction than the outer route.	□ Owing to significantly lower traffic flows and the sparsity of dwellings, there are no dwellings on the outer route adversely affected by traffic noise/ □ Fewer properties along the outer route would experience noise levels in excess of the recommended design limit during construction than the inner route.
Flora and Fauna	□ Passes through land for urban/industrial development, and cleared and substantially modified land for grazing. Flora, fauna and habitat value is poor. □ While no rare or threatened plant species were recorded during field surveys, several species are considered locally or regionally rare. Further reductions should be avoided by protecting or replanting species appropriate to the mixed box woodland or river red gum forest types along road batters and throughout the road easement.	□ The outer route is primarily located in cleared agricultural land where the dominant landuses are grazing and cropping. Some remnant woodland or open forest are present, but grassland is dominant. □ Existing flora communities are in poor condition, meaning that habitats are also poor. Emphasis should therefore be placed on the preservation of remnant woodland and red gum forest, as well as billabongs, and farm dams along the outer route. This would assist with the protection of habitat resources for endangered species such as the swift parrot, regent honeyeater and the turquoise parrot.

(Table continued over)

Table 34.1 -- Continued

Factor	Inner Route	Outer Route
Flora and Fauna Cont'd	□ Impact upon areas designated priority parkland by the Albury Wodonga Regional Parklands Committee.	□ Avoids priority parkland in and around Albury Wodonga.
	□ Impact on bird behaviour as a result of road construction. Appropriate amelioration needed.	□ Impact on bird behaviour as a result of road construction. Appropriate amelioration needed.
		□ An endangered species, the bush stone-curlew was found near the settlement of Jindera.
Riverine Habitat	□ The inner route crossing of the Murray River is shorter, therefore minimising riverine habitat disturbance.	□ The wider crossing of the Murray River floodplain increases the potential for riverine habitat disturbance.
	□ Avoids a number of smaller waterbodies associated with the Murray River.	□ Impacts upon a significant billabong close to the Murray River.
	□ Loss of a stand of River red gums along the Murray River.	□ A loss of trees at the outer route crossing point would occur, but would not be as significant as for the inner route.
	□ It is unlikely that the inner route crossing point would significantly alter hydrological flows.	
Landuse and Property Impacts	□ Visual and noise impacts by passing next to agricultural, industrial, residential and recreational areas.	□ Impacts upon primarily agricultural land.
	□ Existing wide road reserves mean that resumption is minimal (123 hectares).	□ Passes through the Boral brickworks.
	□ Estimated lost production (best practice stocking rate) is $31,150 per year.	□ Estimated lost production (best practice stocking rate) is $101,750 per year.

(Table continued over)

Table 34.1 -- Continued

Factor	Inner Route	Outer Route
Landuse and Property Impacts Cont'd	□ No major impact on utilities and services.	□ No major impact on services and utilities. □ Need to buy land for the outer route from the Albury Wodonga Development Corporation. Resume 403 hectares in total.
Statutory Planning	□ No major impacts on zoning, besides the 7(c) zoning, Environment Protection - Murray River Floodplain Scenic Protection Area, under Hume LEP No. 8, where development of this type is prohibited. A rezoning would need to be undertaken. □ No amendments required in Victoria □ Murray Regional Environmental Plan No. 2 (NSW) applies and requires public authorities to take into consideration issues such as access, bank disturbance, river usage and wetlands. Consultation with the Murray Darling Basin Commission and the local Council is required.	□ The Albury Wodonga Regional Planning Strategy released in 1991 suggests that rural living opportunities be provided around Splitters Creek/Jindera/Bowna. The outer route would pass directly through this area, limiting future opportunities. □ Amendments required in Victoria □ Murray Regional Environmental Plan No. 2 (NSW) applies and requires public authorities to take into consideration issues such as access, bank disturbance, river usage and wetlands. Consultation with the Murray Darling Basin Commission and the local Council is required.
Archaeology	□ Three open campsites and three isolated finds are located on the inner route. □ Two sites have potential archaeological significance, and this should be taken into consideration during the design and construction stages.	□ Seven open camp sites and two isolated finds are located on the outer route. □ Five other sites have potential archaeological significance, and this should be taken into consideration during the design and construction stages.
Heritage	□ The landscape across the Murray River floodplain is classified by the National Trust of Australia and should be taken into account during design and construction work.	□ The landscape across the Murray River floodplain is classified by the National Trust of Australia and should be taken into account during design and construction work.

(Table continued over)

Table 34.1 -- Continued

Factor	Inner Route	Outer Route
Heritage Cont'd	□ The homesteads 'Cambourne' and 'De Kerilleau' should be retained on their sites and be suitably landscaped. □ Eight other items of historical significance are found in the vicinity of the inner route, although none are directly affected by the proposal.	□ The stockyard site found on 'Ring-a-Rah' should be taken into consideration during the design and construction stages. □ One other item of historical significance is found in the vicinity of the outer route, although it is not directly affected by the proposal. □ An agricultural implement should be relocated before construction.
Landscape Character and Visual Impact	□ Significant visual impact because of ramps, and interchanges, particularly in short term. Opportunities for visual improvements and redevelopment of adjacent properties with more suitable urban form.	□ Significant visual impact because of ramps, interchanges, major excavations and new road in rural area. Opportunities for visual improvements with more suitable rural form.
Current Ecological Issues	□ The improved road conditions would lead to reduced car emissions, therefore addressing the issues of climate change and the greenhouse effect. □ The new route would be designed, constructed and maintained in a matter that maximises the life expectancy of the pavement and associated infrastructure in line with Ecologically Sustainable Development. □ Environmental safeguards would be included to re-establish native vegetation species along the proposed route corridor, which over time would provide habitat for fauna species and provide wildlife movement corridors, in line with conserving biological diversity.	□ The improved road conditions would lead to reduced car emissions, therefore addressing the issues of climate change and the greenhouse effect. □ The new route would be designed, constructed and maintained in a matter that maximises the life expectancy of the pavement and associated infrastructure in line with Ecologically Sustainable Development. □ Environmental safeguards would be included to re-establish native vegetation species along the proposed route corridor, which over time would provide habitat for fauna species and provide wildlife movement corridors, in line with conserving biological diversity.

(Table continued over)

Table 34.1 -- Continued

Factor	Inner Route	Outer Route
Current Ecological Issues Cont'd	□ The design of the new route, coupled with environmental safeguards and monitoring would ensure that the environment would not be degraded for existing or future generations. □ The precautions and safeguards recommended with regard to impacts are adequate to reduce the uncertainties surrounding the possible long-term impacts of the development. The proponents are committed to the development of an Environment Management Plan to ensure that the outcomes of the environmental impact assessment process are met during the construction and operations stages.	□ The design of the new route, coupled with environmental safeguards and monitoring would ensure that the environment would not be degraded for existing or future generations. □ The precautions and safeguards recommended with regard to impacts are adequate to reduce the uncertainties surrounding the possible long-term impacts of the development. The proponents are committed to the development of an Environment Management Plan to ensure that the outcomes of the environmental impact assessment process are met during the construction and operations stages.
Energy Conservation	□ 32 million litres of construction fuel consumption. □ Net fuel consumption of 152,890 litres per day. □ Potential fuel savings (compared to existing) of 29,600 litres per day.	□ 47 million of construction fuel consumption. □ Net fuel consumption of 174,180 litres per day. □ Potential fuel savings (compared to existing) of 8,300 litres per day.
Cumulative Impacts	□ The major adverse impacts of the proposed inner route would be noise, property, impact and visual quality. The major impacts would tend to be localised on residents and communities on either side of the route.	□ The major adverse impacts of the proposed outer route would be noise, property impact and visual quality. The major impacts would tend to be localised on residents and communities on either side of the route.
Construction of Proposed Works	□ Approximately 4,500,000 m³ of fill required. □ 3-5 year construction period. Five stages.	□ Approximately 7,300,000 m³ of fill required. □ 3-5 year construction period. Five stages.

(Table continued over)

Table 34.1 -- Continued

Factor	Inner Route	Outer Route
Construction of Proposed Works Cont'd	□ Estimated construction costs: $203 million.	□ Estimated construction costs: $263 million (dual carriageway) and 189 million (single carriageway)
Operational Hazards and Risks	□ Risk for residential areas from flammable liquids and LPG would be reduced and would be extremely low	□ No residential areas along the route. Reduced level of risk, however, risk would also continue along the existing Hume Highway.

34.3 Consequences of No Action or Deferral

If the proposal did not proceed or was deferred extensive rehabilitation works would be needed to be carried out on the existing road pavement. In addition, parts of the existing road network would reach capacity in terms of traffic volumes and level of service causing significant traffic delays and congestion on the Lincoln Causeway and in Albury.

Road safety is also of particular concern to each of the governments involved and accidents would be anticipated to continue to occur at a rate at least similar to that of the past five years. In fact, with projected increases in both through and local traffic volumes, accident rates could be expected to increase at a commensurate rate.

Retention of direct access to properties along the existing highway would continue to compromise safety to both drivers and property owners. Safety and general access conditions at the various intersections along the length of the existing highway would continue to deteriorate with increased traffic volumes on the highway as well as on the intersecting roads. Pedestrian and cyclist safety which is already adversely affected by existing conditions and traffic volumes would be expected to diminish as a result of population growth and increased numbers of vehicles (including heavy transports).

Increased congestion and resultant delays would occur as greater numbers of vehicles attempt to use a road network which is already approaching capacity at some locations such as the Lincoln Causeway. The high volume of heavy vehicles, poor horizontal alignment of large parts of the existing highway and the large number of intersections controlled by traffic lights contribute to the inadequacies and unsatisfactory nature of the current situation. If the Do Nothing Option were adopted it would result in a continued risk to safety and the acceptance of traffic congestion and high levels of maintenance and remedial works. In addition, by adopting the Do Nothing Option the negative impacts of both routes would be avoided but the benefits of those routes would not be captured.

The proposal to implement an improved National Highway route within the study area would reduce accident frequency and provide a level of service consistent with driver expectations and the role of the Hume as a National Highway. It would also consequently lead to travel time savings and a reduction in road user, vehicle operating and accident costs.

If the existing situation of traffic flow in Albury Wodonga were maintained and the proposal not adopted, a poorer environment would develop over time through increased environmental impacts such as noise and air emissions. There would also be an increase in vehicle-to-vehicle and vehicle-to-pedestrian conflicts.

All improvements and savings would be foregone as a result of no action or deferral of the proposal. A further consequence of the proposal not proceeding would be that the status quo would be maintained.

34.4 Justification of the Project

A new route replacing the existing Hume Highway through Albury Wodonga is well justified. This justification is based on the conclusions reached within each of the chapters of Parts C, D, E, F and H. Both the inner and outer routes offer benefits which cannot be achieved with the existing road network. These include:

- Improve the National Highway system.
- Transport economics are improved/enhanced.
- Amenity along the existing route would improve.
- Road capacity could be increased to handle the anticipated demand from traffic into the future.
- Annual travel cost savings to the year 2020 (medium growth scenario) of between $22 million (outer route) and $55 million (inner route) would be achieved.
- The number of accidents resulting from the existing situation with conflicting traffic movements could be reduced with annual accident cost savings (2021) of between $308,800 (outer route) and $1,168,400 (inner route).
- The project would yield a benefit cost ratio (7% discount rate) of between 1.0 for the outer route and 2.2 for the inner route.
- Travel distances between Mullengandra and Barnawartha North would be reduced.
- There would be a substantial reduction in travel times between Mullengandra and Barnawartha North, especially for intercity and regional traffic.

- The existing route has aging flexible pavements requiring high maintenance costs, which would be significantly reduced as a result of the project.

The project would result in an improvement in service, satisfaction of community level demands, improvement in road safety, and reduced travel and road user costs. Additionally, the inner route would satisfy local traffic demands now and in the future.

Further, the inner and outer route options have shown to have no or low impacts on the Albury Wodonga environment. This is in direct comparison to the likely gradual degradation of the environment, should traffic congestion continue to occur in and around Albury Wodonga.

In summary, therefore,

- The investigation has shown that either route option would not significantly affect the natural landform or the hydrology of the area.

- Although one endangered species was found in the flora, fauna and habitat surveys of the area, it is not seriously threatened by either proposal if the suggested mitigation measures are put in place.

- Landuses, both existing and future, are not affected greatly by the project. Measures such as stock and traffic underpasses, minor amounts of acquisition and appropriate compensation would be used to overcome these impacts.

- The heritage of the area is not generally affected by either proposal. Archaeological sites are located within the corridors; these are however, of low significance or can be further assessed or recovered during the design stage.

- The visual quality of the region would be affected by the project, but adverse impact to the area would be reduced by implementing the recommended landscape strategy. In the East Albury area visual amenity would be improved by the road project which includes the provision of landscaping.

Both routes were developed in the context of minimising impacts on the physical, social and economic environments, while providing road user benefits. The investigation has shown that each route offers substantial benefits over the existing road network while minimising those impacts.

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