AUSTRALIA CANNOT LEAD THE WORLD IN POLICY TO REDUCE THE IMPACT OF CLIMATE CHANGE IF ITS NATIONAL CAPITAL HAS AMONGST THE HIGHEST CARBON EMISSIONS PER CAPITA OF ANY CITY IN THE WORLD.
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01 Executive summary
1 Executive summary

The ACT is seeking funding to provide for a light rail system in Canberra to achieve its goal to build the nation’s capital into a more sustainable and liveable city.

From its inception, Canberra has been planned to reflect the prevailing transport environment. In the days prior to mass private motor vehicle ownership, Walter Burley-Griffin’s design included the provision of trams operating in the suburbs and central areas. However, major growth of the city occurred in an era when private motor vehicle ownership had become widespread. This, combined with cheap, and at the time seemingly unlimited supplies, of fuel made the car the predominant form of transport for the city. It also led to planning decisions to significantly extend Canberra’s urban form and use transport corridors between the city and town centres for private vehicle transport. The result is a dispersed, low density, urban form, undeveloped public transport infrastructure and increasing traffic congestion.

Canberra’s existing transport system is not sustainable from an environmental, economic and social perspective and is already imposing significant costs on the ACT economy and society.

In the new environment of climate change, rising fuel prices and peak oil, policies are being implemented in land use and transport planning to address these challenges. It is clear that a light rail system would substantially enable Canberra to adapt to and address these challenges.

This proposal follows the format requested by Infrastructure Australia and follows the keys steps that Infrastructure Australia will use to determine the Infrastructure Priority List and, in doing so, is a self audit of the project.

Consequently the audit framework undertaken by the ACT Government has included the following six steps:

Figure 1: Diagram of the 6 step process of Infrastructure Australia
Overview of the project

The proposed light rail network is shown in Figure 2 and includes the Belconnen, Tuggeranong, Gungahlin and Kingston routes. Where possible the routes will run in dedicated reserves on either the side of the roadway or in the median strip with limited land purchases given a high use of crown land and vacant reserves. The collective length of the proposed network is 54.43km.

Route staging and lengths are shown in Table 1 below.

A number of major structures will be required for the introduction of the route. These include:

- bridges across Lake Burley Griffin
- a rail road crossing at Barry Drive
- a bridge across Macarthur Avenue
- an underpass beneath Gungahlin Drive
- a rail under road crossing for Northbourne Avenue

<table>
<thead>
<tr>
<th>Stage 1 Routes</th>
<th>Distance (Km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belconnen</td>
<td>9.49</td>
</tr>
<tr>
<td>Tuggeranong</td>
<td>21.34</td>
</tr>
<tr>
<td>Gungahlin</td>
<td>13.00</td>
</tr>
<tr>
<td>Kingston/Manuka</td>
<td>10.60</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>54.43</strong></td>
</tr>
</tbody>
</table>

Figure 2 highlights the proposed routes of the light rail systems.

Construction is expected to commence in 2011 and be fully completed by 2015. It has been assumed that the first section the Belconnen and Tuggeranong routes will be completed within two years and operations will commence immediately when this section is open.
Executive summary

Figure 2: Proposed routes of the light rail system (indicative only)
Executive summary

Meeting the Strategic Goals of Infrastructure Australia

In undertaking the Infrastructure Australia audit, the seven strategic goals have been specifically considered and in most cases are met. A summary of the project against each objective is provided in Table 2.

<table>
<thead>
<tr>
<th>Expand Australia’s productive capacity</th>
<th>The development of a light rail system will decrease Canberra’s traffic congestion and people’s commuting time. As a result Australia’s productivity will increase because the number of hours available for people to work will increase.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase Australia’s productivity</td>
<td>Canberra is currently experiencing difficulty in attracting sufficient skilled labour on both a national and international front. The liveability of Canberra is being affected by increasing congestion levels. These two issues are affecting the ACT and the Australian Public Service productivity and productive capacity</td>
</tr>
<tr>
<td>Diversify Australia’s economic capabilities</td>
<td>A light rail system which improves the efficiency of public transport in Canberra can support diversified economic opportunities including education and high technology industries.</td>
</tr>
<tr>
<td>Build on Australia’s global competitive advantage</td>
<td>Light rail in the ACT will have only a slight impact on Australia’s global competitive advantage.</td>
</tr>
<tr>
<td>Develop our cities and/or regions</td>
<td>Canberra’s current transport system is unsustainable. Canberra has the highest carbon emissions from passenger car transport per capita of any Australian capital city and growing levels of congestion which are projected to increase are imposing a cost on the ACT community in economic, environmental and social terms. These costs will continue to grow. Therefore, improvements need to be made to the current transport system. A light rail system can assist with this improvement process.</td>
</tr>
<tr>
<td>Reduce greenhouse emissions</td>
<td>Light rail will reduce congestion on Canberra streets which in turn will reduce greenhouse gas emissions and air pollution.</td>
</tr>
<tr>
<td>Improve social, equity and quality of life in our cities and regions</td>
<td>Canberra’s existing transport system is not sustainable from an environmental, economic and social perspective and is already imposing significant costs on the ACT economy and society. Light rail will contribute to greater levels of social inclusion in the ACT.</td>
</tr>
</tbody>
</table>
Executive summary

Goal definition

The significance of this project is not only its alignment with the strategic goals of Infrastructure Australia, but the opportunity to demonstrate Australian innovation and leadership.

To ensure a strategic and coordinated approach to transport planning, this project focuses on the economic, environmental and social goals of the ACT. These economic, environmental and social goals have been strategically identified and outlined in the Canberra Plan and subsidiary plans on climate change, skilled labour and transport.

Specifically, the goals of the Canberra Plan are outlined in the following quote:

"Canberra will be recognised throughout the world as a truly sustainable and creative city; as a community that is socially inclusive - acknowledging and supporting those who are vulnerable and in need and enabling all to reach their full potential; as a centre of economic growth and innovation; as the proud capital of the nation and home of its pre-eminent cultural institutions; and as a place of great natural beauty."

An integral component in this goal is “… as the proud capital of the nation...”

These goals replicate the seven strategic goals of Infrastructure Australia.

For Australia to lead the world in sustainable economic, social and environmental policy, Australia’s capital city must provide a leading example not only to Australia but to the rest of the world.

Canberra has amongst the highest carbon emissions per capita of any city of the world because it has, over recent decades, been planned for the predominance of cars. Australia cannot lead the world in policy to reduce the impact and severity of climate change if its national capital has amongst the highest carbon emissions per capita of any city in the world.

Through a commitment to integration of transport and land use planning there is an opportunity to utilise a light rail system to influence urban form and public transport in a way which will make the national capital Australia’s exemplar sustainable city.

This proposal for the development of light rail in Canberra, how it meets the goals of the Canberra Plan and how it meets the strategic objectives of Infrastructure Australia are summarised in Figure 3.
Executive summary

Figure 3: Strategic objectives of Light Rail meeting Infrastructure Australia Goals

Goal

**Sustainable transport**

With this plan, Canberra will achieve a transport system that has lower overall costs, particularly lower greenhouse gas emissions, lower air pollution, reduced accidents and lower health costs, and provides more transport options for the community. The transport system will also support the achievement of the economic and social goals for Canberra as outlined in The Canberra Plan.

Problem identification

**Unsustainable transport**

Co2 emissions from passenger vehicle use per persons are:
- Canberra – 2,150 kg
- Other Australian capital cities – 1,744 kg

By 2031, 62km of Canberra’s roads will have a V/C ratio of 0.95 or more.

Problem assessment

**Economic, environmental and social consequences**

- Canberra’s traffic congestion costs
- Environmental and health impact

Solution

**Light Rail**

↑ Public transport use
↓ Car use

Problem analysis

**High car use and low public transport use**

Travel to and from work
- Cars
  - Canberra – 81.1%
  - Australia – 76.1%
- Public transport
  - Canberra – 7.9%
  - Australia – 15.2%

IA strategic goals

**Light rail meets IA goals by...**

↑ Productive capacity
↑ Quality of life
↑ Australia’s competitive advantage
↑ Diversification of economic activity
↑ Social equity
↓ Greenhouse gas emissions
Problem identification

The ACT community and the ACT Government are working hard to achieve the goals outlined in the Canberra Plan and the more detailed plans that support it.

Restricting achievement of these goals is the current ACT transport system which is not sustainable. As identified in the ACT Sustainable Transport Plan, the current transport system is not sustainable because:

- Canberra’s carbon emissions from passenger car transport per capita is the highest of any state capital in Australia: and
- growing levels of congestion, which are projected to increase, are imposing a cost on the ACT community in economic, environmental and social terms and these costs will continue to grow.

Without intervention now, and without a coordinated strategic plan, Canberra’s transport environment and traffic is destined to resemble that currently being experienced in the more populous capital cities of Australia. Particularly, in the context of congestion, this proposal is intended to avoid the impending problem which will inevitably develop based on the experiences of Sydney and Melbourne.

As Australia is seeking to lead the world in policy to reduce the severity of climate change it follows that Australia’s capital city should also take action. Since there is no heavy industry in the ACT there are more limited options available to ACT residents to make a contribution. Reducing carbon emissions from passenger motor vehicles is one of these opportunities.

Problem assessment

The impacts of climate change on the Australian environment and economy are outlined in the Garnaut report. The ACT is likely to be impacted severely by climate change in that:

- the ACT and surrounding region is likely to become warmer over the coming decades, with more hot days and fewer cold nights
- droughts are likely to become more frequent in the ACT
- temperature related illness and death is expected to rise
- there is likely to be an increase in food and water borne diseases – due to changes in water quality and the range of bacteria and pests
- there is likely to be an increase in vector borne diseases – from a change in the range of mosquitoes and other disease carrying species.
Executive summary

- there is likely to be an increase in injury, trauma and related effects from an increase in extreme weather conditions.¹

Worsening congestion and growth in travel costs and travel times will clearly impact adversely on the liveability of Canberra. This will exacerbate skills shortages experienced across the ACT workforce, including the Australian public service. The ACT already has the lowest unemployment rate of any state or territory in Australia. If Canberra cannot resolve its unsustainable transport problems, the ACT economy and the maintenance of a high quality Australian public sector to administer a range of key government functions are at risk.

¹ Ibid p.17
Problem analysis

Canberra’s relatively small population and low density means that changing commuting modes and patterns offers the greatest opportunity to achieve significant improvements in the per capita carbon emissions of Canberrans and thereby improve the sustainability of transport in the city.

“As economic growth leads to increased demand, an economy can ultimately become the victim of its own success because as congestion rises, so it starts to dampen growth. This is the most direct way in which transport will impact on growth in a developed economy, and such congestion effects can be particularly damaging in agglomerations…”2

Canberra has a relatively low population dispersed over a large area. The low-density city form makes it difficult and expensive for the public transport system to serve a wide range of needs. Effectively, Canberra has a high per capita public transport service (in terms of kilometres of service per capita) that is spread thinly over a large area. This results in low frequency of services and high costs across many routes.

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2 The Eddington Transport Study: The case for action: Sir Rod Eddington’s advice to Government December 2006 p. 16
Executive summary

Options generation

Due to the ACT Government being in caretaker mode during the preparation of this submission and due to time constraints imposed by Infrastructure Australia, the ACT Government has been unable to undertake cost benefit analyses on all the options available to deliver sustainable transport in the ACT. However, a number of potential solutions have been identified. These include:

1. development of more roads
2. increase buses on existing grid
3. dedicated bus-ways
4. light rail developed in coordination with a bus feeder service.
5. increased parking charges
6. congestion taxes
7. urban infill.

It is recognised by the ACT Government that no one comprehensive solution exists. As identified in both the Canberra Plan and the Sustainable Transport Plan, achievement of a sustainable transport system will involve a number of strategically coordinated projects, policies and community involvement.

The advantage of light rail however, is that it would provide the backbone of a fully integrated set of transport policies which already have significant community and wide ranging support.

Solution assessment

The economic appraisal framework used to appraise the economic viability of the Canberra Light Rail is based on generalised multimodal cost benefit analysis (CBA) methodology. Like all CBA frameworks, the multimodal approach requires the appraisal of projects on an incremental basis, ie comparing the Project Case to the Base Case.

The cost benefit analysis undertaken on the Canberra light rail system indicated a positive economic net benefit (that is a benefit cost ratio (BCR) of greater than one) against all three discount rates prescribed by Infrastructure Australia, with a mid-point BCR (based on a seven per cent discount rate) of 1.62. While this presents a net economic benefit to society it should be noted that delays in implementing this project, and as such delays in realising the benefits, will necessarily increase the BCR to the extent that the differential between the base case and the test case will grow, reflecting such things as increased congestion in the base case over time.

As implied from this, the net present value (NPV) of the Canberra light rail project is positive under all discounting scenarios, ranging from $2,825m to $227m, with a mid-point estimate of $1,014m (based on a seven per cent discount rate).
Goal definition
2 Goal definition

In 2004 the goals for the Australian Capital Territory were defined, agreed, formalised and quantified in The Canberra Plan. These were reviewed and updated in 2008 in The Canberra Plan: Towards a Second Century. These policies provide a vision for Canberra as a community and as the capital city of Australia.

In essence, the Canberra Plan addresses the seven strategic priorities that Infrastructure Australia will use to evaluate projects and has set specific goals for many of them.

Under the umbrella of the Canberra Plan are a number of other policy documents which provide more detailed goals for Australia’s capital city. These include:

- Weathering the Change: The ACT Climate Change Strategy 2007-2025
- The Sustainable Transport Plan for the ACT
- The Integrated Transport Framework
- ACT Skills Future
- Building Our Community: The Canberra Social Plan.

Drawn from these well established policy frameworks and strategies, three specific goals have been identified as being supported by light rail.

1. A sustainable transport system
2. Transport integration
3. Addressing climate change.

Figure 4 outlines this project’s fundamental, economic, environmental and social goals.

Figure 4: Fundamental, economic, environmental and social goals
The Canberra Plan

The Canberra Plan was launched in 2004 to guide the growth and development of Canberra for this generation and beyond. It set out a strategy that reflected the views and values of Canberrans and responded to the challenges facing Canberra.

*The Canberra Plan: Towards Our Second Century* built on the original *Canberra Plan* by articulating key directions for the city’s continued prosperity as it approaches its second century. It also responds to new challenges that have emerged or intensified since 2004. These include climate change, water security, housing affordability and skills shortages.

The vision of the 2004 Canberra Plan was:

Canberra will be recognised throughout the world not only as the beautiful city, uniquely designed in harmony with the environment, the seat of Australia’s government and the home of its pre-eminent national institutions - but also as a place that represents the best in Australian creativity, community living and sustainable development.

This vision was complemented by other key plans, including Building Our Community: The Canberra Social Plan, which envisaged that:

We become a place where all people reach their potential, make a contribution and share the benefits of our community.

Underpinning the Plan’s vision was the concept of sustainability. This recognises that innovation and creativity must be encouraged in order to continue strong economic growth, that the causes of disadvantage and social exclusion must be addressed if all citizens are to share in the city’s prosperity, and that our natural and built environment must be kept healthy so that all in the community can enjoy the recreational and personal well-being benefits they offer. Light rail would clearly support these objectives, through the provision of improved public transport options and accessibility and reductions in congestion and greenhouse gas emissions.

The vision for The Canberra Plan: Towards Our Second Century encompasses all these elements and embraces the concept of social inclusion and sustainability.

Canberra will be recognised throughout the world as a truly sustainable and creative city; as a community that is socially inclusive acknowledging and supporting those who are vulnerable and in need and enabling all to reach their full potential; as a centre of economic growth and innovation; as the proud capital of the nation and home of its pre-eminent cultural institutions; and as a place of great natural beauty.

In 2004, the foundations of the Canberra Plan included the Economic White Paper, Building Our Community, the Canberra Social Plan and the Canberra Spatial Plan. The Canberra Plan: Towards Our Second Century continues to embrace the social, spatial, economic and sustainability framework articulated in the original Canberra Plan and the associated strategic plans.
Light rail has, for many years, been identified and supported by a wide range of business and community groups, as a means of achieving sustainable transport objectives.

The Canberra Plan: Towards Our Second Century reflects ongoing consultation by the ACT Government with key stakeholders and the community on a wide range of issues. The ACT business community and the tertiary sectors were consulted about the main economic and regional issues facing the ACT.

The ACT Community Inclusion Board convened a forum to obtain input from the community sector on issues and areas of focus for Building Our Community: The Canberra Social Plan.

Extensive consultation was undertaken to refine the Territory Plan and implement the reforms to the planning system introduced in March 2008.

In addition, the ACT Government convened the ACT 2020 Summit - a precursor to the national Australia 2020 Summit - at the National Convention Centre on 5 April 2008. The summit brought together more than 300 Canberrans with expertise in various sectors: health, education, environmental sciences, the arts, business, information technology, sport, tourism, community support, spirituality and economics. Despite their diverse backgrounds, all participants shared a passion for the national capital and its community, and a commitment to building an inspiring and sustainable future.

In the Canberra Plan and The Sustainable Transport Plan an underlying objective and theme of a sustainable transport system has been constant. Light rail has, for many years, been identified and supported by a wide range of business and community groups, as a means of achieving sustainable transport objectives.

Goal 1: Implementing a sustainable transport system

In 2004, under the umbrella of the Canberra Plan, the ACT Government released The Sustainable Transport Plan for the ACT. The Sustainable Transport Plan is one of a number of specific plans that provided more detailed goals to achieve the broader Canberra Plan goals. These goals are well agreed and some have specific targets.

The Sustainable Transport Plan is one of two core documents that make up the ACT’s “planning strategy” under Section 440 of the Planning and Development Act 2007 and is part of the Government’s commitment to improve transport in the ACT. It provides the direction and actions to achieve a more sustainable transport system over the next 25 years.

Specifically its goals and objectives include:

- lower overall transport system cost; and
- lower greenhouse gas emissions

while supporting economic and social goals set out in the Canberra Plan.

Restricting achievement of these goals is the current ACT transport system which is not sustainable because:
Goal definition

- Canberra’s carbon emissions from passenger car transport is the highest of any state capital in Australia; and
- growing levels of congestion, which are projected to increase, are imposing a cost on the ACT community in economic, environmental and social terms and these costs will continue to grow.

Significantly, the current transport system is characterised by high mean travel distances per capita and being passenger car/road dominated it does not support the need to establish a more sustainable, compact city form.

The plan is based on a comprehensive analysis of transport issues and options from a number of studies undertaken by consultants for the then Department of Urban Services and the ACT Planning and Land Authority. The three main studies are The ACT Transport Costing Study, The ACT Transport Demand Elasticities Study and The Public Transport Futures Feasibility Study.

“With this plan, Canberra will achieve a transport system that has lower overall costs, particularly lower greenhouse gas emissions, lower air pollution, reduced accidents and lower health costs, and provides more transport options for the community. The transport system will also support the achievement of the economic and social goals for Canberra as outlined in The Canberra Plan.”

Quantifying this goal

Key elements of The Sustainable Transport Plan complement the ACT Government’s Sustainability Framework and Greenhouse Strategy as outlined in Weathering the Change. The STP also supports the nationally adopted Charter for Integrated Transport and Land Use Planning.

The Sustainable Transport Plan seeks to increase the use of sustainable transport modes (walking, cycling and public transport) from 13 per cent of work trips in 2001 to 20 per cent in 2011 and 30 per cent in 2026.

Table 3 shows the quantified goals for the ACT’s Sustainable Transport Plan.
Goal definition

Table 3: Sustainable transport plan targets: Percentage of trips by mode (journey to work trips)

<table>
<thead>
<tr>
<th>Mode</th>
<th>2001 %</th>
<th>2011 %</th>
<th>2026 %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walking</td>
<td>4.1</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>Cycling</td>
<td>2.3</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>Public transport</td>
<td>6.7</td>
<td>9</td>
<td>16</td>
</tr>
<tr>
<td>Total</td>
<td>13.1</td>
<td>20</td>
<td>30</td>
</tr>
</tbody>
</table>

Source: ACT Government - The Sustainable Transport Plan for the ACT p.ii

The development of a light rail system would support achievement of these goals.

Objectives over the longer term

To be more sustainable, Canberra’s future transport system will have a greater emphasis on active transport modes – walking and cycling – and public transport. Technical analysis indicates this is essential for the future and that, implemented appropriately, such a system will:

- help maintain high levels of accessibility
- improve equity of access to transport for the whole community
- provide more transport choices
- reduce the costs of transport, including Government costs, users’ costs, accident costs, greenhouse gas emissions, noise, air pollution and other negative environmental effects of transport.

A sustainable transport system will also:

- support the achievement of the ACT’s economic strategies
- support the vitality, amenity and attractiveness of the city
- make Canberra a better place to live, visit, study and do business
- encourage Canberrans to be more active and healthy
- help reduce the spread and land take of Canberra.

Goal 2: Implementing an integrated transport framework

The ACT Integrated Transport Framework provides a foundation for decision making which will support the development of a sustainable transport system. It recognises the strong relationships between each of the components of the transport system and establishes a set of principles to govern consideration of transport policies and initiatives both now and in the future. These principles require that transport measures:
Goal definition

- promote economic growth and effectiveness
- develop a transport system that meets the needs of the ACT community
- promote a city form and transport options that minimises greenhouse gas emissions: and
- integrate transport priorities and land use planning.

The development of a light rail system as a component of an integrated ACT transport system clearly satisfies each of these principles.

Quantifying this goal

Transport elasticities studies previously undertaken show that improving public transport travel times is the most important factor in encouraging greater use of public transport. Travel times include in-vehicle times and time to walk to and from the bus. Average door to door travel times for public transport in Canberra are almost twice the average for cars. Frequency, reliability, comfort safety accessibility and affordability are important considerations to peoples transport decision making.

Light rail provides an opportunity to enhance the transport system to deliver levels of service which will influence mode choice and increase the rate at which car commuters are prepared to switch to public transport.

Objectives over the longer term

Canberra's commitment to an integrated transport system would be supported by light rail, through:

- net benefits for the ACT economy by improving the efficiency of the whole transport system, especially by integrating the transport system within and with land use planning and development;
- reduced traffic congestion within Canberra central area;
- improved social inclusion outcomes for the ACT community; and
- reduced level of overall transport emissions.

Goal 3: Addressing climate change

Transport in the ACT contributes approximately 24% of total greenhouse gas emission levels. A clear objective of implementing a light rail system is to put in place public transport infrastructure and services that directly address this issue. If the private motor vehicle and public transport use in the ACT aligned with the national average (meaning an additional 6,500 people per year catching public transport or another alternative mode of transport to work), 3,900 tonnes less of CO₂ would be produced each year.

Canberra has set a goal for a reduction of 60% of 2000 levels of greenhouse gas emissions by 2050.
Goal definition

Quantify these goals

A goal of a reduction of 60% of 2000 levels of greenhouse gas emissions by 2050 has been set under the ACT’s Climate Change Strategy. As a milestone and in keeping with this timeframe a goal has been established to limit greenhouse gas emissions to 2000 levels by 2025.

Objectives over the longer term

The targets set out in the ACT Climate Change Strategy, will be supported by the implementation of an integrated transport system which maximises the use of sustainable transport modes, including light rail. Specifically, light rail will contribute to:

- stabilisation (and over time, reduction) of transport emissions
- improved urban design which will reduce the land take for new dwellings and further reduce greenhouse gas emissions.

Summary

In summary the implementation of light rail provides an opportunity for the ACT Government to achieve a range of its strategic goals and, at the same time address the specific goals of Infrastructure Australia.

Table 4 outlines how the Canberra Plan’s broad goals are aligned with the objectives of Infrastructure Australia’s seven strategic priorities.
Goal definition

Table 4: The Canberra Plan and Sustainable Transport Plan aligned with Infrastructure Australia’s seven Strategic Priorities

<table>
<thead>
<tr>
<th>Infrastructure Australia strategic goals</th>
<th>Canberra Plan goals/Sustainable Transport Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Expand Australia’s productivity</td>
<td>“centre of economic growth and innovation”</td>
</tr>
<tr>
<td>2 Increase Australia’s productivity</td>
<td>“enabling all to reach their full potential”</td>
</tr>
<tr>
<td></td>
<td>“reduced accidents and lower health costs”</td>
</tr>
<tr>
<td>3 Diversify Australia’s economic capabilities</td>
<td>“centre of economic growth and innovation”</td>
</tr>
<tr>
<td>4 Build on Australia’s competitive advantages</td>
<td>“centre of economic growth and innovation”</td>
</tr>
<tr>
<td>5 Develop our cities and regions</td>
<td>“capital of the nation and home of its pre-eminent national institutions”</td>
</tr>
<tr>
<td>6 Reduce greenhouse gas emissions</td>
<td>“sustainable”, “lower greenhouse gas emissions”</td>
</tr>
<tr>
<td>7 Improve social equity and quality of life</td>
<td>“socially inclusive”, “more transport options for the community” “lower air pollution”</td>
</tr>
</tbody>
</table>

Canberra will be recognised throughout the world as a truly sustainable and creative city; as a community that is socially inclusive – acknowledging and supporting those who are vulnerable and in need and enabling all to reach their full potential; as a centre of economic growth and innovation; as the proud capital of the nation and home of its pre-eminent cultural institutions; and as a place of great natural beauty.

ACT Sustainable Transport Plan

With this plan, Canberra will achieve a transport system that has lower overall costs, particularly lower greenhouse gas emissions, lower air pollution, reduced accidents and lower health costs, and provides more transport options for the community. The transport system will also support the achievement of the economic and social goals for Canberra as outlined in The Canberra Plan.
Problem identification
Problem identification

3 Problem identification

The ACT’s current transport system is not sustainable and is incapable of achieving the goals outlined in section 2 of this submission. Achieving sustainability will require changes to transport patterns and mode choice which will only be achieved by a substantial investment in public transport infrastructure. There are a number of factors which are holding back the ACT’s ability to create a sustainable transport system which in turn are holding back its ability to meet wider economic and social goals. These are:

- increasing congestion and travel times
- high carbon emissions per capita.

These two problems are in part a function of Canberra’s low density and highly dispersed urban form, which encourages car use and makes public transport provision costly and challenging.

Figure 5 summarises how each of these deficiencies impedes the ACT’s ability to meet the goals outlined in the Canberra Plan and the Sustainable Transport Plan.

Figure 5: Deficiencies

<table>
<thead>
<tr>
<th>Problem identified</th>
<th>Unsustainable transport</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Deficiencies</strong></td>
<td><strong>Affects these goals</strong></td>
</tr>
<tr>
<td>High carbon emissions and pollution</td>
<td>&quot;sustainable&quot;</td>
</tr>
<tr>
<td></td>
<td>&quot;lower greenhouse gas emissions&quot;</td>
</tr>
<tr>
<td></td>
<td>&quot;lower air pollution&quot;</td>
</tr>
<tr>
<td>Increasing congestion and travel times</td>
<td>&quot;centre of economic growth and innovation&quot;</td>
</tr>
<tr>
<td></td>
<td>&quot;enabling all to reach their full potential&quot;</td>
</tr>
<tr>
<td></td>
<td>&quot;reduced accidents and lower health costs&quot;</td>
</tr>
<tr>
<td></td>
<td>&quot;socially inclusive&quot;</td>
</tr>
<tr>
<td></td>
<td>&quot;capital of the nation and home of its pre-eminent national institutions&quot;</td>
</tr>
</tbody>
</table>

High carbon emissions

Australia has among the highest carbon emissions per capita in the world as shown in Figure 6 below.

The ACT’s contribution to total carbon emissions in Australia is modest at 1.2 per cent of total carbon emissions. Although the ACT has no heavy industry or coal burning electricity generators which make such a large contribution to emission levels in other states, Canberra’s per capita CO₂ emissions as a result of passenger vehicle use are the highest of any capital city in Australia.
In 2005, CO$_2$ emissions as a result of passenger vehicle use in Canberra were 2,150 kilograms per person.$^4$

This compares to an average of 1,744 kilograms per person in the other capital cities in Australia.

One reason for Canberra’s large per capita passenger transport emission compared to other states is the low use of public transport in the ACT. Canberra has the lowest use of public transport of Australian capital cities and the highest use of motor vehicles. This is discussed in Chapter 4 “problem analysis”.

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$^4$ Derived from data based on the BTRE working paper 71, The Garnaut Report, data from the NRMA website and Sustainable Transport and Canberra 2008– Challenges and Opportunities -G.Currie
Increasing congestion and travel times

“In most cases, the best signals to identify where transport is acting to hold back growth will be the presence of clear signs of economic success (economic growth and very high wages and land prices), and that transport demand is starting to outstrip supply signs of congestion and unreliability.”

While congestion in the ACT is not yet at the levels experienced in some other cities in Australia, it is important to identify the issue now to allow enough time to develop and implement effective transport and land use policies and plan to ensure that Canberra will not be in this position in 20 years time.

Road congestion in the ACT is expected to increase significantly over the next 20 years.

Road congestion can be measured using a volume to capacity ratio - that is the amount of traffic using/wanting to use the road compared to its theoretical maximum. As this ratio moves towards 1, congestion gets progressively worse, resulting in low speeds and increased variability in journey times.

For volume to capacity ratios below 0.7, traffic speeds and journey time reliability will generally be acceptable. Between 0.75 and 0.85 journey speeds begin to decrease and journey time can become unreliable as congestion can grow quickly. At this ratio, traffic accidents begin to have a significant impact on congestion. Once the volume to capacity ratio exceeds 0.95 road speeds slow significantly, even to a stand still.

Table 5 shows the estimated number of kilometres that will be affected by congestion in the ACT over a number of time frames.

Table 5: Estimated length of congested roads, 2011, 2021 and 2031 (kilometres)

<table>
<thead>
<tr>
<th>V/C ratio</th>
<th>2011</th>
<th>2021</th>
<th>2031</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.75 – 0.85</td>
<td>61</td>
<td>54</td>
<td>75</td>
</tr>
<tr>
<td>0.85 – 0.9</td>
<td>26</td>
<td>31</td>
<td>33</td>
</tr>
<tr>
<td>0.9 – 0.95</td>
<td>14</td>
<td>41</td>
<td>38</td>
</tr>
<tr>
<td>0.95 – 1.0</td>
<td>26</td>
<td>37</td>
<td>51</td>
</tr>
<tr>
<td>&gt;1.0</td>
<td>10</td>
<td>21</td>
<td>29</td>
</tr>
</tbody>
</table>

Table 5 shows that the level of congestion on Canberra roads will increase significantly over the next 20 years. The total kilometres of road affected by congestion (that is with a V/C ratio greater than 0.75) will be 137 kilometres by 2011 and 226 kilometres by 2031.

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5 The Eddington Transport Study: The case for action: Sir Rod Eddington’s advice to Government December 2006
Figure 7 represents the projected morning peak hour congestion levels which will be experienced in Canberra by 2021. The red shaded areas represent a VC of > 1, whilst the blue areas represent a VC of > .90.

If one of the key objectives and goals of the Sustainable Transport Plan is to decrease carbon emissions then the building of more roads to reduce congestion is not considered a sustainable approach.

As illustrated in Figure 8 two factors which influence the high congestion cost to Canberra and Australia is the relationship of car ownership and urban density.

The number of kilometres of road severely affected by congestion will be 58 by 2011 and 80 by 2031.
Problem identification

Figure 8: Motor vehicle ownership and urban density

Motor Vehicle Ownership

Urban Density

Source: Institute of Transport Studies, Monash University
Problem assessment
4 Problem assessment

High carbon emissions

“Growth in emissions is expected to have a severe and costly impact on agriculture, infrastructure, biodiversity and ecosystems in Australia.”

“These impacts would be significantly reduced with ambitious global mitigation.”

Australia is seeking to lead the world in implementing policies to reduce the severity of climate change. The ACT is strongly committed to building a lower carbon Canberra, and meeting its Weathering the Change target of a reduction of carbon emissions to 60% of 2000 levels by 2050. Since there is no heavy industry in the ACT there are few options available to its residents to make a contribution. Reducing carbon emissions from passenger motor vehicles is one of these opportunities.

Transport contributes around 24% of the ACT’s emissions. The Canberra community therefore needs to ‘green’ its travel choices – but the community can only make an environmental travel mode choice if a sustainable transport option like light rail is available.

The impact of high carbon emissions on the Australian economy are outlined in the Garnaut Climate Change Review and are well known. For the purpose of this report the impacts of climate change described are limited to those impacting on the ACT. However, they should be seen within the broader context of the ACT’s contribution to global greenhouse gas emissions and global policies to mitigate the impact of climate change.

Impacts of climate change on the ACT community

The CSIRO has developed future climate change predictions for Southeast NSW, including the ACT.

- The ACT and surrounding region is likely to become warmer over the coming decades, with more hot days and fewer cold nights. The number of days in Canberra above 35 degrees Celsius could average 6 to 14 by 2030 up from 5 days a year now.

- Droughts are likely to become more frequent in the ACT. By 2030, the CSIRO expects that the frequency of droughts in the ACT will increase by 70 per cent for the worst case scenario.

- Greater run off from storms and higher evaporation from higher overall temperatures will lead to less water being available for consumption and there will be a reduction in water quality.

6 The Garnaut Climate Change Review p. 121
Problem assessment

- Wind speeds are predicted to increase across South East NSW during summer months. Data from insurance companies indicate that severe winds account for around 40 per cent of damage to Australian residential buildings.\(^7\)

Climate change will also have health effects on the ACT community. These include:

- temperature related illness and death is expected to rise
- there is likely to be an increase in food and water borne diseases – due to changes in water quality and the range of bacteria and pests
- there is likely to be an increase in vector borne diseases – from a change in the range of mosquitoes and other disease carrying species
- there is likely to be an increase in injury, trauma and related effects from an increase in extreme weather conditions.\(^8\)

Increasing congestion and travel times

Congestion imposes significant economic and social costs on society. Congestion causes interruptions to traffic flow, lengthening average journey times; it makes trip times more variable and motor vehicle engine operation less efficient. In estimating the cost of congestion, allowances are made for:

- extra travel time (for example above that for vehicle travel under less congested conditions)
- extra travel time variability (where congestion can result in trip times becoming more uncertain—leading to travellers having to allow for an even greater amount of travel time than the average journey time, in order to avoid being late at their destination)
- increased vehicle operating costs (primarily higher rates of fuel consumption)
- poorer air quality (with vehicles under congested conditions emitting higher rates of noxious pollutants than under more freely flowing conditions, leading to even higher health costs).\(^9\)

In turn each of these factors has economic, social and quality of life impacts for the community. Figure 9 shows how these costs map through to Infrastructure Australia’s 7 strategic goals. Each of these impacts is described in more detail in the following pages.

\(^7\) Weathering the Change: The ACT Climate Change Strategy 2007-2025. p. 16
\(^8\) Ibid p.17
\(^9\) BTRE Working paper 71 2007 p. 10
### Problem assessment

#### Figure 9: Costs of congestion and Infrastructure Australia’s strategic goals

<table>
<thead>
<tr>
<th>Congestion impact</th>
<th>Impact on IA Strategic Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase in travel time</td>
<td>Increased travel time:</td>
</tr>
<tr>
<td></td>
<td>• Reduces the hours that individuals can work on average across the economy. Less hours worked equates to lower GDP and lower productive capacity.</td>
</tr>
<tr>
<td></td>
<td>• Reduces quality of life through less leisure time and time spent with family.</td>
</tr>
<tr>
<td></td>
<td>• Reduces Australia’s competitive advantage by making Australia less favourable as a location for commercial activity.</td>
</tr>
<tr>
<td></td>
<td>• Reduces the ability for communities to share knowledge which impacts on diversification of economic activity.</td>
</tr>
<tr>
<td></td>
<td>• Reduces social equity by making it more difficult to travel to work or for community activities.</td>
</tr>
<tr>
<td>Increase time variability</td>
<td></td>
</tr>
<tr>
<td>Increased vehicle operating costs</td>
<td>Increased vehicle operating costs:</td>
</tr>
<tr>
<td></td>
<td>• Increases the cost of output per worker and per machine (motor-vehicle) reducing productivity.</td>
</tr>
<tr>
<td></td>
<td>• Reduces the number of hours that workers and machines (motor-vehicles) operate, reducing productive capacity.</td>
</tr>
<tr>
<td></td>
<td>• Reduces competitive advantage if other competitor countries have lower congestion.</td>
</tr>
<tr>
<td>Poorer air quality</td>
<td>Poorer air quality:</td>
</tr>
<tr>
<td></td>
<td>• Increases greenhouse gases.</td>
</tr>
<tr>
<td></td>
<td>• Reduces quality of life by having a negative impact on health.</td>
</tr>
<tr>
<td></td>
<td>• Reduces productivity by negatively impacting on the health of labour and reducing output per hour.</td>
</tr>
<tr>
<td></td>
<td>• Reduces productive capacity through increased morbidity.</td>
</tr>
<tr>
<td></td>
<td>• Holds back the development of cities.</td>
</tr>
</tbody>
</table>
Costs of congestion

The Eddington Transport Study completed in December 2006 for the UK Government is one of the most detailed recent studies providing advice on transport. The study identifies what users want from a transport system:

- Short journey time
- Journey time reliability
- Affordability
- Network coverage
- Comfort
- Safety
- Security.

Congestion impacts on many of these factors. Rod Eddington summarises the impact:

“When users experience an improvement or worsening of these characteristics, they feed through to impact on the economy through a variety of mechanisms – increasing business efficiency, investment and innovation, improving functioning of agglomerations and labour markets, increasing competition, increasing trade and attracting globally mobile resources.”

The costs of congestion for Australia have been quantified and are higher in Australia than in most other developed countries relative to the size of the economy.

Congestion is estimated to cost 2.6 per cent of GDP in Australia, well above the average of 2.0 per cent for OECD countries.

Figure 10 shows the relative average cost of congestion as a proportion of GDP for Australia, the United States, Western Europe and OECD countries.

10 The Eddington Transport Study: The case for action: Sir Rod Eddington’s advice to Government December 2006.
11 Ibid p. 34
Without intervention now, and without a coordinated strategic plan Canberra’s transport environment and traffic is destined to resemble those currently being experienced in the more populous capital cities of Australia.

Congestion in Canberra is not yet at the levels experienced in Sydney and Melbourne. However, congestion and the cost of congestion is expected to grow considerably over the next 30 years. Without intervention now, Canberra’s transport environment and traffic is destined to resemble those currently being experienced in the more populous capital cities of Australia. In the context of congestion, this proposal therefore is not one of “fixing” a problem, but, with the aid of hindsight experiences of Sydney and Melbourne, is a project that will enable the nation’s capital to “avoid” a problem.

As the Australian economy has grown in recent years, so too has energy consumption. Australia’s per capita greenhouse gas emissions due to energy are the third highest of any OECD country and the seventh highest in the world. Much of this energy comes from energy generation and transport fuels.

Climate change mitigation requires new investment and reforms to fill infrastructure gaps and make the most efficient use of existing infrastructure. As depicted in figure 11, stationary energy and transport are the two largest contributors to greenhouse emissions in Australian economy, contributing around 50 and 14 percent of national emissions respectively.
Problem assessment

For the ACT, most of the green house emissions are created by its heavy use of electricity and its transport system. The profile for the ACT is significantly different to the national profile, reflecting that lack of industry and agriculture in the ACT, and a transport system dominated by private vehicles.

The ACT currently emits approximately 4.45 million tonnes of green house gasses per year of which 23.5 percent or 1.05 million tonnes is generated by transport fuels. Overall, per capita emissions have increased by nearly 10 percent since 1990 and expected to increase significant if there is no change to current practices.

As depicted in Figure 12, transport contributes a far greater amount of greenhouse emissions in the ACT than the national average.

This is because Canberra has the lowest per capita use of public transport of all capital cities in Australia. Hence the high reliance on private vehicles (a legacy of how Canberra was designed) means that the contribution to the ACT’s carbon emission by the transport sector is high compared to the national average.

Figure 12: Greenhouse emissions by sector for the ACT

Source: Weathering the Change- ACT Climate Change Strategy 2007-2005
Impact of congestion in the ACT on Infrastructure Australia’s Strategic Goals

The BTRE estimated that avoidable traffic congestion costs for Australian capital cities was $9.4 billion in 2005\textsuperscript{13}. This cost was comprised of elements that impact on productive capacity, quality of life and productivity.

*Increase in travel time and increase in time variability*

An increase in travel time and increase in time variability has negative impacts on:

- productive capacity
- quality of life
- Australia’s competitive advantage
- social equity
- diversification of economic activity.

*Productive capacity and productivity*

The more time spent commuting the less time is available for other activities. Some of these activities will be leisure time or time spent on community activities. The remaining time will be manifest in less time spent at work. The BTRE estimates that the cost of congestion to businesses in 2005 was $3.6 billion.

A key factor which determines productive capacity is the number of hours available for work. Where congestion reduces the number of hours available for work, Australia’s productive capacity is reduced.

A second factor is that traffic congestion increases travel time for commercial activities. That is, the transaction costs of doing business increase if there is more time taken transporting goods, or more time spent by individuals in reaching their destination to provide services.

Canberra has significant difficulty attracting sufficiently skilled labour. The quality of life impacts that are discussed below from increasing congestion are also impacting on the productive capacity of the ACT and the Australian Public Service. Two indications of the ACT’s tight labour market and the economic constraints it is facing are:

- an unemployment rate of 2.7 per cent, the lowest of any state or territory

\textsuperscript{13} BTRE Working paper 71 2007 p. 13
Problem assessment

- a ratio of employment vacancies to labour force which is the highest in any state and territory.

While transport is only one factor of many that impacts on Canberra’s attractiveness as a place to work, it is a factor which is taken into account when people consider where to live and work. Increasing congestion over the next 20 to 30 years will take away one of the advantages that Canberra has relative to other cities, and possibly worsen what is already a severe skill shortage problem.

Quality of life and social equity

More time spent commuting detracts from time that individuals can spend doing other activities that are not work related but which still have a value to themselves and society.

Social equity can also be affected by high traffic congestion as increasing commuting times may make employment in a particular area less attractive.

The impact of the ACT’s current transport system on social equity is larger than in most cities in the world due to Canberra’s large geographical spread. For example, while London has about three times the spatial area as Canberra, it has 24 times the population. This supports a far higher level of public transport coverage and frequency than is affordable for low density Canberra. The potential for Canberrans living on the outskirts of the city to be marginalized due to limited public transport options and high reliance on private motor vehicles is relatively higher than for those on the outskirts of London.

Figure 13 identifies the comparative analysis of density between Canberra and London.

Figure 13: Analysis of density

Source Institute of Transport Studies Monash University

Congestion also has a disproportional impact on social minorities, and the “transport disadvantaged” who tend to reside on Canberra’s urban fringes and have limited public transport access at present. By 2051 over 25% of the...
population of the ACT will be over the age of 65. Efficient transport is essential to equitable access, particularly for the aged, disabled or socially and transport disadvantaged. Mobility is critical to the physical, social and psychological well being of these groups and is a significant factor determining their quality of life. Physical health depends upon access to medical facilities and other social services. The ability to maintain active social networks depends on accessibility to family and friends as well as recreational and cultural activities. Psychological health is enhanced by unrestricted mobility that allows choice of a range of destinations and the attainment of freedom from possible isolation at home.

**Increased vehicle operating costs**

Congestion directly impacts vehicle operating costs. Vehicle maintenance, petrol, insurance and residual values are directly related to the driving environment, traffic flows and urban form.

Savings in congestion time brought about by an improved commuter system therefore reduces these operating costs, resulting in a redirecting of economic resources. Hence congestion reduction directly influences the economic allocation of resources.

Modelling undertaken for this project indicates that the economic benefits derived by implementation of a light rail system would result in vehicle operating costs being reduced by $32.54 million in 2021 and $34.52 million by 2031.

**Poorer air quality**

Air quality has direct and indirect impacts on a number of Infrastructure Australia’s strategic goals. Air quality has direct impact on social equity and the development of cities through its impact on the health of individuals. However, it also impacts on productive capacity and productivity by causing higher rates of mortality and morbidity.

In 2000 ambient air pollution caused by motor vehicles caused an estimated 2,700 cases of morbidity and 1,400 cases of premature death in Australia. The main causes were cardio-vascular problems, bronchitis and other respiratory diseases. The cost of death and disease from motor-vehicle pollution is estimated to be between $2.9 billion and $3.9 billion in 2000.

The premature death of an individual or their incapacitation as a result of pollution caused by passenger transport reduces the productive capacity of the economy. It is acknowledged however that presently air pollution within Canberra falls within WHO guidelines and as such any increased congestion is unlikely to increase it to levels outside these guidelines.

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14. BTRE Working paper 63, Health impacts of Transport Emissions in Australian
15. Ibid
Problem analysis
5 Problem analysis

Canberra’s urban planning history and low levels of density are resulting in high CO₂ emissions per capita from passenger motor vehicle use, and growing rates of congestion. A further symptom of the car-based city is its low use of public transport compared to other Australian capital cities. Figure 14 below maps the primary and secondary causes of the identified problems.

Figure 14: Primary and Secondary Causes

<table>
<thead>
<tr>
<th>Urban planning history</th>
<th>High reliance of cars</th>
<th>High carbon emissions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Density</td>
<td>Low rate of public transport use</td>
<td>Increasing traffic congestion</td>
</tr>
<tr>
<td>Canberra Y Plan</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Canberra’s planning history

Canberra is recognised internationally for its planning heritage. It is lauded for its landscape quality, the formality of the Parliamentary Triangle, the dispersed town centres and because it has tried to plan ahead to meet changing social needs. While Walter Burley-Griffin’s gazetted design included the provision of trams operating in Canberra’s suburbs and central area, the city began to be constructed in an era where cars had become the predominant form of transport. In the 1960s and 70s, the Y-Plan established inter-town public transport corridors.

The Y-Plan was predicated on a system of main roads and peripheral parkways for traffic movement, with corridors reserved for future rapid public transport along the spines of the urban form. The aim of the plan was that people would work near where they live, and have safe, convenient and quick access to make the city more productive. The ACT economy already derives economic benefits in regional centres from agglomeration because of this strong planning history.

Canberra’s planning over the years has continued to recognise the role of these corridors to support an effective public transport system. However, development patterns and trends have not only failed to reinforce the role of the transport corridors for the provision of effective public transport, but appropriated the corridors primarily for travel by private motor vehicles. Consequently, Canberra remains a heavily car dependent city. A rapid transit system remains a gap in the delivery of Canberra's transport and city planning.
High car use and low public transport use

Emissions from transport in Australia have grown rapidly in response to increased demand for transport. In particular, the use of high emission transport modes has increased with growing incomes, resulting in a shift away from public transport to individual car usage. Figure 15 below shows that compared with journeys to work in other Australian capital cities, Canberrans used their cars more, used public transport less and walked and cycled significantly more.

Figure 15: Mode of travel (Journey to work compared to Australian capital cities)

Source: ABS Census of Population and Housing, 2006

While cars continue to be used for most work trips in the ACT, there has been a small improvement in the share of alternative transport modes. The 2006 Census indicates that car driver numbers are declining slightly, while the mode shares for public transport and walking are increasing. This probably reflects the urban infill action already taken by the ACT Government, though no definitive data is yet available.

Canberra’s small population and low density means that changing commuting modes and patterns offers the greatest opportunity to achieve significant improvements in per capita carbon emissions and thereby improve the sustainability of transport in the city. Since such a large number of people travel to and from work by private car, providing an improved transport option such as light rail, coordinated with supportive strategic policies would provide this opportunity to change.

Based on a comparison of the ‘car-as-passenger’ share of journey-to-work travel between 2001 and 2006, the Census figures suggest that there has been an increase of about 6% in the number of people car sharing in

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16 Source ABS census 2006
Problem analysis

Canberra. While Canberra already has one of the highest rates of car pooling in Australia, this is another opportunity by which the city can reduce its transport emissions through behaviour change.

Canberra’s existing public transport system

Canberra’s only existing public transport is a road-based bus network (ACTION buses), which is publicly owned and regulated. Due to Canberra’s urban form, the current bus network is designed around service coverage, such as public transport routes within 400 metres of 90 per cent of residents. This results in circuitous routes and longer journey times, with bus travel times on average more than twice the travel time for a private vehicle.

While there are some existing bus transit lanes, for the most part, buses share the roads with passenger vehicles, which contributes to slower travel times, and adds to the congestion problem. Because of the distances covered, the service level supplied by Canberra buses in terms of kilometres per head is one of the highest levels of public transport service in Australia.

Canberra has low population densities dispersed over a large area. The low-density city form makes it difficult and expensive for the public transport system to serve a wide range of needs. Effectively, Canberra has a high per capita public transport service that is spread thinly over a large area thereby contributing to low frequency of services and high costs across many routes.

Figure 16 shows population density of selected cities.

Figure 16: Urban density


Other contributing factors

The car remains the main form of transport in the ACT, with the 2006 census indicating that nearly 84% of all journeys to work by ACT residents are made
Problem analysis

by motor vehicle. This is due in large part to the unique nature of the city, its urban spread and range of other characteristics which impede the achievement of a sustainable transport environment. Figure 17 identifies a range of these issues that contribute to the current transport problem faced by the ACT.

Figure 17: ACT’s sustainable transport problems

The need for a change in urban form

Canberra’s planning still affords it the scope for successful adaptation to emerging challenges of climate change, uncertain economic times and social exclusion. For Canberra to become a more sustainable city, people need to have the opportunity to choose a more sustainable lifestyle, which can be promoted by less reliance on private motor vehicles. The implementation of light rail would allow for land use planning to move closer to the original intentions of the National Capital Plan. This approach could allow for more mixed use land development around transit corridors and town centres/employment nodes, and an increase in residential density without compromising amenity and accessibility. It would facilitate the creation of a city where people can reduce their carbon footprint and reap the improved lifestyle benefits.

Integrating Land Use and Transport Planning

The Canberra Spatial Plan identifies the need for Canberra to become more compact in order to reduce its large environmental footprint. The key strategies put forward to achieve this were moving the next Greenfield development front to the west in the Molonglo Valley and intensifying development within the current urban area. It is this second strategy that offers the capital the greatest benefit in meeting the challenges:
Problem analysis

- from demographic change in being able to provide for more affordable and greater choice in dwellings that will suit smaller households
- from better affordability for the government in service provision, and for Canberrans who could take advantage of better housing choice located closer to affordable transport
- from climate change in being able to reduce the high mean trip lengths that Canberrans travel between work, home and recreation
- from cultural change in being able to re-establish safe, vibrant commercial areas close to home that are venues for social exchange and participation.

The road based system needs to be supplemented by effective rapid public transport to support this urban intensification. Intensification particularly along transit routes greatly increases transport accessibility, as more people live within walking or cycling distance of a light rail station. Other land use benefits of a light rail system supported by urban intensification along transit routes would include:

- More opportunities for consolidating Commonwealth offices in the city and Parliamentary triangle to increase productivity
- The ACT’s unique leasehold system – which unlike any other part of Australia would facilitate land value capture along the rapid transit corridors
- A chance to optimise the economic yield of the Canberra central area – ie an opportunity to change land in the city from low value to high value use
- Social element - social inclusion through better transport accessibility and urban consolidation.

A light rail system combined with integrated transport and land use planning would represent significant progress in achieving social, economic and environmental goals in line with the Canberra Plan and other planning documents, and would make the most of Canberra’s strong planning heritage, which anticipated a rapid transit system like light rail.
Option generation
6 Option generation

There are a number of policy options which could be adopted by the ACT Government to reduce the impact of the problems of high carbon emissions per capita and increasing congestion. However, it needs to be recognised that the ACT is already undertaking several measures to improve the sustainability of public transport. These measures include:

- investing in infrastructure to increase bicycle use
- adopting a policy of urban in-fill through the Spatial Plan
- planning for integrated transport and land use.

Due to the ACT Government being in Caretaker mode and the limited time to provide the proposal to Infrastructure Australia it has not been possible to conduct a cost benefit analysis on alternative options to light rail, which include:

- more roads
- buses on the existing grid
- bus rapid transit
- light rail
- increased parking charges
- congestion charges
- urban infill.

Figure 18 provides a high level evaluation of each option’s potential to contribute to sustainable transport in the ACT. The options are evaluated against criteria which would assist in Canberra achieving sustainable transport. They are evaluated against their ability to influence the two problems identified and assessed in sections 2 and 3:

1. **Greenhouse gas reduction** – Canberra’s currently has the highest per capita passenger motor vehicle related greenhouse gas emissions in Australia.
2. **Congestion** – Canberra has increasing congestion and costs of congestion.

They are also evaluated against secondary criteria which would assist in achieving these higher level goals or would be positive additional benefits to the broader ACT community. These include:

3. **Accident levels** – the option is to have minimal impact on increasing potential accidents.
4. **Impact of existing congestion levels** – the better transport solution is one that is not affected by the levels of congestion it is attempting to solve.
5. **Consumer preference** – consumers have different preferences for different types of transport with some having higher take-up rates than others.
6. **Equity** – the type of transport solution has an impact on equity.

Figure 18: Relative merits of transport options for the ACT

<table>
<thead>
<tr>
<th></th>
<th>Reduces carbon emissions</th>
<th>Reduces congestion</th>
<th>Reduces accidents</th>
<th>Unaffected by existing congestion</th>
<th>Consumer preference</th>
<th>Improves equity</th>
</tr>
</thead>
<tbody>
<tr>
<td>More roads</td>
<td><img src="#" alt="Red" /></td>
<td><img src="#" alt="Red" /></td>
<td><img src="#" alt="Red" /></td>
<td><img src="#" alt="Green" /></td>
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</tr>
<tr>
<td>Buses on existing grid</td>
<td><img src="#" alt="Yellow" /></td>
<td><img src="#" alt="Neutral" /></td>
<td><img src="#" alt="Neutral" /></td>
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<td>Increase parking charges</td>
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<td>Congestion charges</td>
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<td><img src="#" alt="Star" /></td>
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</tr>
</tbody>
</table>

- **Red** - Negative impact against the assessed criteria
- **Yellow** - Neutral impact against the assessed criteria
- **Green** - Positive Impact against the assessed criteria
- **Star** - Non stand alone policies

**Roads**

More road capacity can reduce congestion but cannot reduce carbon emissions. Reduced congestion encourages greater car use and greater carbon emissions and will not make Canberra transport more sustainable in environmental terms. That said, the ACT acknowledges in its Integrated Transport Framework that the car is likely to remain the main transport mode
Option generation

for the majority of Canberrans, and has committed to maximising its investments in road infrastructure to make the road network as efficient as possible.17

Buses on existing transport network

Increasing the number of buses on the existing network can reduce congestion and carbon emissions if there is substitution away from car use to bus use. However, simply adding more buses may not increase bus use if there is no additional demand for public transport - complementary measures are also necessary to encourage bus use. Placing additional buses on the existing transport network would potentially have the following disadvantages:

- Buses are affected by existing levels of congestion and do not provide direct travel opportunities, which increase journey time and reduce demand.
- As a result, their ability to reduce carbon emissions is also limited by these factors.
- Consumers have a preference against bus travel which limits the number of people who will transfer to new buses and bus routes.
- Although new technologies are producing low emissions buses, in general, buses are not the lowest emissions public transport systems currently available.

Bus lanes

Bus lanes are specially marked lanes that can only be used by buses, taxis, emergency vehicles, and motorcycles. They are located on major public transport corridors which have high frequency bus services and no bus stops. More buses can reduce congestion and carbon emissions only if there is substitution away from car use to bus use. Simply adding more buses may not increase bus use if there is no additional demand for public transport. Hence to be an effective alternative, travel time savings need to be sufficient to change commuter habits. This could be achieved through implementing a series of complementary parking policies and congestion charges.

Bus rapid transit

Infrastructure investment for the development of a bus rapid transit system, with exclusive right of way arrangements for buses, is considered a viable alternative given the lower capital expenditure costs than light rail. Consequently, bus rapid transit would warrant a comparative cost benefit analysis study with light rail to determine the most effective use of economic resources. Due to the time constraints on this project, such a comparison has not been included in this analysis.

Light Rail

“Light rail is an inflexible, fixed route mode but this is an advantage over bus as it means the service has a degree of permanency. The very flexibility of bus becomes a disadvantage as services can readily be changed.”

A text by Haus-Klau, “Light rail and bus: making the right choice,” summarises the results of a worldwide study of buses and light rail. They found that the operating speed is similar for bus rapid transit and light rail and the costs are similar but that light rail is slightly cheaper than buses on a lifetime basis. It also shows that the pollution and noise considerations favour light rail over buses but that new technology may see this advantage eroded.

The next three options are marked with an asterix in Figure 18 as they are not stand alone policies which can reduce carbon emissions or congestion. These measures influence people to increase their use of public transport. Hence they can be used only in conjunction with bus or rail options, and form part of a coordinated sustainable transport strategy to influence community choices about their mode of commuting.

Increasing parking charges

By increasing the cost of car travel consumers can be encouraged into using public transport. This option can help to reduce carbon emissions and congestion but only in conjunction with increased investment in public transport (eg more buses on more routes, or rapid public transit like light rail).

Congestion charges

Road pricing based on charging users for their level of use and levels of congestion will encourage them to travel more efficiently as well as providing a source of funds for transport investment. However, this option cannot reduce congestion and carbon emissions by itself. It must be used in conjunction with additional access to public transport.

Congestion charging could also have social and equity impacts, as often those who must travel the furthest are those living in outer suburbs and who are in the lower socio-economic groups. Outer suburbs are usually the least well serviced by public transport.

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18 Haus-Klau Light Rail and Bus: Making the Right Choice 2000
19 The Sustainable Transport Plan for the ACT p. 25
20 Ibid
Urban infill

Governments have a major role to play in lowering the economic costs of adjustment to higher oil prices, an emissions price and population growth, through planning for more compact urban forms and rail and public transport. Mode shift may account for a quarter of emissions reductions in urban passenger transport, lowering the cost of transition and delivering multiple benefits to the community.21 Ross Garnaut

Higher density developments at key nodes and public transport interchanges, and a mix of land uses, allows more people to access public transport and to walk and cycle. Increased population density and employment at town centres and nodes along transport corridors can also improve public transport viability. This then helps create a snowball effect, in that greater use of the system justifies improvements to the system.

Changing to public transport is beneficial to health outcomes. Exposure to air pollution is lowest for train travel and significantly lower for cyclists and walkers. Bus travellers experience similar overall exposure as car passengers.

In addition to improved air quality, public transport contributes to better health. Taking public transport requires more activity at the beginning and end of the trip than does private motor vehicle use. The costs of physical inactivity in Australia are well documented and are rising, with the direct costs estimated to be around $400 million a year.22

Transit oriented development

Transit oriented development is a concept that encourages mixed use, compact development near public transport stations. There, the built environment facilitates alternative modes of transport thereby reducing the reliance on the motor vehicle. It also provides opportunities for businesses to cluster around a public transport station, leading to economic gains through economies of scale.

Over a 25 to 30 year period, the potential for urban consolidation in suburbs in North Canberra, including the City, South Canberra and the town centres of Woden, Belconnen and Tuggeranong could accommodate an additional 40,000 persons. These 40,000 persons would represent approximately 16,000-17,000 new dwellings by means of urban consolidation, with an effective infrastructure saving of $495 million in comparison to urban fringe development over a 25 to 30 year period.23

Clearly, the enabling catalyst underpinning the support for transit oriented development is the implementation of a light rail system in existing areas identified for urban infill.

21 Ross Garnaut: The Garnaut Climate Change Review p. 503
23 Public Transport Futures Feasibility Study (PTFSS)
Option generation
07 Solution assessment
7 Solution assessment

(a) Summary of assessment

This section of the report presents the summary of the cost benefit analysis.

Cost benefit analysis

The cost benefit analysis undertaken on the ACT light rail proposal indicated a positive economic net benefit (that is a benefit cost ratio (BCR) of greater than one) against all three discount rates prescribed by Infrastructure Australia, with a mid-point BCR (based on a seven per cent discount rate) of 1.62. While this presents a net economic benefit to society it should be noted that delays in implementing this project, and as such delays in realising the benefits will necessarily increase the BCR to the extent that the differential between the base case and the test case will grow, reflecting such things as increased congestion in the base case over time.

As implied from this, the net present value (NPV) of the light rail proposal is positive under all discounting scenarios, ranging from $2,825.47m to $227.18m, with a mid-point estimate of $1,014.38m (based on a seven per cent discount rate).

The economic internal rate of return of the project is approximately twelve per cent across all scenarios, which reflects the calculations applying to the raw (or undiscounted) economic flows.

The NPVI, which presents the NPV as a portion of total investment in the project (represented as capital and operating costs combined) varies from 1.29 to 0.17 with a mid-point of 0.62 (based on a seven per cent discount rate).

These results are summarised in the Table 6 below.

<table>
<thead>
<tr>
<th>Table 6: Summary of Cost-Benefit Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discount Rate (%)</td>
</tr>
<tr>
<td>4%</td>
</tr>
<tr>
<td>BCR</td>
</tr>
<tr>
<td>NPV ($m, 2008 dollars) ie ‘Net Benefit’</td>
</tr>
<tr>
<td>IRR</td>
</tr>
<tr>
<td>NPVI</td>
</tr>
</tbody>
</table>
Appraisal objective

This appraisal has been undertaken in accordance with the relevant guidelines and requirements provided by Infrastructure Australia.

From an economic perspective, the key challenge for Infrastructure Australia is to determine whether the Canberra community will enjoy a net benefit from the construction and operation of the light rail system. As such, the objective of this section of the report is to estimate and compare the net economic benefit of the project and hence, guide the efficient allocation of public resources. This is done by determining whether the light rail proposal is economically viable (i.e., the total discounted incremental benefits within the project exceed the total discounted incremental costs over a specified period – in this case 30 years).

(b) Methodology

This section of the report presents the appraisal framework and key assumptions that form the economic appraisal.

Economic appraisal framework

The economic appraisal framework used to appraise the economic viability of the light rail proposal is based on generalised multimodal cost benefit analysis (CBA) methodology. Like all CBA frameworks, the multimodal approach requires the appraisal of projects on an incremental basis, i.e., comparing the Project Case to the Base Case.

The CBA in this study is used to assess the light rail proposal in the context of the following parameters:

1. Project capital costs
2. Project recurrent costs
3. Vehicle operating costs
4. Public transport user travel time costs
5. Decongestion costs
6. Externalities (environmental costs).

This CBA reports on the following measures of economic performance:

1. Benefit Cost Ratio (BCR) – ratio of the PV of total incremental benefits over the PV of total incremental costs.
2. Net Present Value (NPV) – the difference between the present value (PV) of total incremental benefits and the present value of the total incremental costs.
3. Net Present Value : Investment Ratio (NPVI) – the NPV is divided by the PV of the investment costs (PVI).
4. Internal Rate of Return (IRR) – the discount rate at which the PV of benefits equals the PV of costs.
Solution assessment

Scenarios that yield a positive NPV indicate that the incremental benefits of the light rail exceed the incremental costs over the evaluation period. The NPVI measures the overall economic return in relation to the required capital expenditure.

While IRR has been calculated, based on the raw (undiscounted) cash flows, the IRR can yield ambiguous results if the stream of costs and benefits are not continuous over time. It is therefore commonly recommended that the IRR be used only in financial analysis.

Finally, a BCR greater than 1.0 indicates that a project is economically viable.

(c) Methodological assumptions

The general assumptions used in this economic appraisal are as follows:

1. Cash flows are expressed for financial years ending June (YEJ).
2. Cash flows are included in the period in which they occur.
3. The base year is 2008.
4. All values are expressed in constant dollars.
5. Prices are expressed in 2008 dollars.
6. The appraisal period starts in 2011 and ends in 2041 – with costs and benefit projections from 2031 to 2041 based on a straight line extrapolation of the movement from 2021 to 2031.
7. Future net benefits are discounted to the base year of 2008 using discount rates of 4, 7 and 10%.

Additional, project specific assumptions are discussed further in the remainder of this section as well as Appendix G: Economic model notes and assumptions.

Definition of appraisal scenarios

This report appraises a light rail system compared with the Base Case to generate incremental values. The Base Case and the light rail case are defined below:

Base case

The Base Case scenario represents the existing situation if a light rail system is not constructed. It includes the public and private transport infrastructure and service improvements which would occur in the absence of light rail.

The development of the Base Case is guided on the principle that no light rail network would be implemented.
Project case

The light rail proposal involves the construction of a rail service that consists of four dedicated transport corridors (routes). The collective length of the proposed network is approximately 54 kilometres in length. Figure 19 below shows the proposed network.

Figure 19: Light Rail Network (indicative only)

More specific details on the proposed routes are outlined in Kellogg Brown & Pty Ltd’s 2004 Canberra Public Transport Futures Feasibility Study. For the purpose of the CBA for this report it is assumed that the construction of the light rail system will commence in 2011 and that it will be fully completed within four years. It has been assumed that the first section will be completed within two years and operations will commence immediately this section is opened.
(d) Passenger demand for completion of the light rail proposal

Passenger demand for the Canberra light rail is of fundamental importance to the benefits outlined in the cost benefit analysis.

Methodology

The methodology for calculating passenger demand is based on the complete ACT road network and includes such things as current and projected congestion, the type of trip undertaken (eg home to work or home to shops), the demographic profile of various zonal areas across the ACT, the amount of commercial businesses in a particular zone and the relative speed of various modes of transport.

Outputs

The economic appraisal is based on the demand modelling methodology outlined above. The basic form of the demand forecasts for the Light Rail proposal and Base Case include:

1. Passenger trips by mode (Rail, Bus, Car).
2. Passenger hours by mode (in-vehicle time) IVT crowded, IVT not crowded, out of vehicle time (OVT) (access), OVT (wait).
3. Public transport and car passenger kilometres.
4. Service kilometres by public transport mode.
5. Outputs are provided for the forecast years 2011, 2016, 2021, 2026 and 2031. The values for intermediate years are linearly interpolated.

Annualisation

The number of trips undertaken in any scenario is based on an AM peak observation. This data is then annualised using different factors to calculate the annual trip numbers by traffic on road, passengers (on public transport) and the number of public transport services. These factors are shown in the Table 7 below:

Table 7: Annualisation factors

<table>
<thead>
<tr>
<th></th>
<th>AM Peak to weekday factor</th>
<th>Weekday trip to annual factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public transport vehicle</td>
<td>4.2</td>
<td>315</td>
</tr>
<tr>
<td>Public Transport passengers</td>
<td>6.7</td>
<td>315</td>
</tr>
</tbody>
</table>
Demand ramp

As outlined above, while construction of the light rail system commences in 2011 and takes four years to complete, the first section will not be open until 2013; as such the passenger demand does not commence until 2013 and is not reflective of full operational services until 2015. Demand continues to ramp after this point based on the demand methodology outlined above.

Incremental demand impacts

The outputs are structured in order to identify the following incremental demand impacts:

1. Changes in traffic (highway) speed and service kilometres by mode.
2. Changes in passenger trips attributable to ‘mode stayers’, mode diverters and induced trips, by mode.
3. Changes in passenger hours attributable to ‘mode stayers’, mode diverters and induced trips, by mode.
4. Further segmentation of demand is guided by the extent to which differential values of travel time can be applied to better reflect the marginal cost of travel time. Potential areas include the segmentation of data in terms of:
   - peak and off-peak travel
   - trip purpose
   - vehicle class.
(e) Costs and benefits of the light rail proposal

This section of the report defines the economic costs and benefits that are contained in the analysis, and presents the cost and benefit profile of the Project Case.

Definition of the economic benefits

The benefits of the light rail proposal are related to savings in transport user costs due to a reduction in vehicle hours and vehicle kilometres compared with the Base Case. The residual value of assets remaining at the end of the analysis period is also captured. The benefits therefore include:

1. Private transport user cost savings:
   a. savings in the resource value of vehicle operating costs
   b. savings in decongestion
   c. savings in externality costs.
2. Public transport cost savings;
   a. savings in fleet purchase costs
   b. savings in fleet operating costs
   c. savings in passenger time.
3. Savings in travel time costs.
4. Residual value of assets.

As the modelling does not include a transfer fare, for moving between various types of public transport (eg catching a bus and a train on the same journey only attracts one fare) estimating incremental fare revenue is very difficult. As such, and consistent with generally accepted convention, fare revenue is attached to the hierarchical mode, in this case light rail.

Valuing the cost savings

The perceived cost of travel should include mode specific factors that reflect the perceived merits of the specific modes of public transport. The monetisation of the user and non-user costs involve applying the relevant road user cost parameters to the outputs of the demand modelling as per below.

Travel time savings

Travel time - the modelled data included both in-vehicle time (IVT) and waiting and access time (out-of-vehicle time - OVT). Conventionally, OVT and crowded conditions is valued at a higher rate than IVT non-crowded conditions because of the higher disutility associated with these activities. The base IVT
is assumed to be $13.00 per passenger hour, the weighted value of peak and off peak travel time and is applied to all modes. This figure is based on advice provided by ATC\textsuperscript{24} and has been adjusted to reflect the Canberra market.

**Vehicle operating cost (VOC) savings**

The light rail proposal will result in reduced car kilometres on the network. VOC are a function of the length of a journey, traffic volume, vehicle speed, road condition (surface roughness) and characteristics (ie gradient). However, aspect of VOC are captured in decongestion cost savings, hence caution needs to be taken when examining these costs to ensure double counting does not occur. Bearing this in mind, total VOC are comprised of:

1. Basic running costs (fixed and operational) of the vehicle, such as depreciation, fuel, repairs and maintenance.
2. Additional running costs due to road surface.
3. Additional running costs due to any significant speed fluctuations from cruise speed.
4. Additional fuel costs due to stopping, such as queuing at traffic signals.

However, perceived VOC (such as fuel) have been stripped out of the analysis of VOC as these costs would probably have been factored into a person’s modal decision and hence influence the levels of demand and mode diversion. Due to this, perceived VOC would be captured in the value of travel time and hence are a factor of decongestion costs savings.

Therefore, only resource VOC has been included in the economic appraisal. These other costs that would not have been factored into a person’s choice of mode, such as vehicle depreciation, repairs etc are not included in the VOC saving.

The resource cost correction is $0.45 per km for cars and $2.85 per km for trucks. This proportion of resource costs compared to total VOC has then been applied to generate the resource cost for all vehicle types. These figures have then been weighted to derive a weighted resource VOC of $0.71 cents per km.

**Decongestion cost savings**

The light rail proposal will result in reduced car kilometres on the network. Such reductions lead to improved travel times for road users, improved road conditions, with marginally less congestion. Freed-up road space might in fact be taken up by new users, leaving congestion conditions unchanged, but there are presumably benefits in these new road users making their trips, otherwise they would not make them.

Thus, there are either benefits to remaining road users with less congestion or increased benefits to new road users. It is assumed that the benefits of the

\textsuperscript{24} ATC National Guidelines for Transport Systems Management in Australia
new public transport options can be measured in terms of reduced road congestion. The base unit for road decongestion benefit was $0.46/car kilometre.

However, decongestion benefits for light and heavy commercial vehicles will by nature be greater than car benefits, due to higher values of travel time. To ensure that decongestion benefits were also captured for these additional vehicle classes, this base unit of $0.46/car kilometre was weighted against the differing values of travel time for the vehicle classes and the compositions of these vehicles on urban roads. This resulted in a weighted value of decongestion cost savings of $0.54/vehicle kilometre.

Environmental cost savings

The change in service kilometres by mode with light rail would lead to impacts on non-users. This evaluation quantifies the external costs with the base case and light rail proposal, by mode, for the following environmental externalities:

- Air pollution – valued at $0.0396/VKT per rail car, $0.2861/VKT for bus and $0.0254/VKT for car.25
- Greenhouse gas – valued at $0.0064/VKT per rail car, $0.1179/VKT for bus and $0.0200/VKT for car.26
- Noise pollution – valued at $0.0204/VKT per rail car, $0.2599/VKT for bus and $0.0526/VKT for car.

Accident costs

Light rail will result in savings in accident numbers. This is because accident rates are a function of speed volume/capacity ratio and accident rates/motor vehicle kilometre for each road type which will be influenced by the implementation of the light rail system. The savings in accidents costs were calculated using the following rates:

- Fatality – $1,870,585
- Injury – $150,000
- Property damage – $17,518

In addition to the direct crash cost savings, the model estimate includes the savings of time due to the avoidance of crashes.

Residual (terminal) values

Residual value has been assigned to the key components of fixed infrastructure, rolling stock and land with economic lives which extend beyond the final year of the evaluation period. The following economic lives are assigned by infrastructure component:

25 City Rail 2008, A Compendium of CityRail Travel Statistics – Sixth Edition
26 City Rail 2008, A Compendium of CityRail Travel Statistics – Sixth Edition
1. Fixed infrastructure (eg track and tunnels) – 100 years
2. Earthworks and drainage – 40 years
3. Stations – 50 years
4. Rail cars – 35 years.

Each item is depreciated in a straight line fashion to determine the residual value based on construction year.

## Costs of the light rail proposal

The economic appraisal explicitly identifies the project costs which comprise the Base Case and the options. The key cost components include:

### Capital costs

Fixed infrastructure capital costs include road works, track works, service relocations, street and landscaping, bridge structures, traffic management, station/stop facilities, traffic signals.

Based on preliminary advice, total capital costs are $2,019 billion in undiscounted terms. Components of total capital costs are detailed below in Table 8 below.

<table>
<thead>
<tr>
<th>Cost Item</th>
<th>Cost ($M)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road works</td>
<td>$81.80</td>
</tr>
<tr>
<td>Track works</td>
<td>$249.50</td>
</tr>
<tr>
<td>Bridge structures</td>
<td>$151.58</td>
</tr>
<tr>
<td>Light rail vehicles</td>
<td>$507.36</td>
</tr>
<tr>
<td>Depots</td>
<td>$106.17</td>
</tr>
<tr>
<td>Communication control</td>
<td>$98.80</td>
</tr>
<tr>
<td>Service Relocations</td>
<td>$174.91</td>
</tr>
<tr>
<td>Project Management</td>
<td>$158.22</td>
</tr>
<tr>
<td>Power substations</td>
<td>$87.88</td>
</tr>
<tr>
<td>Other costs</td>
<td>$403.30</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$2,019.53</strong></td>
</tr>
</tbody>
</table>

### Recurrent costs

Recurrent, or variable, costs are defined as those costs that recur, as opposed to capital, or fixed, costs, which are concentrated at the beginning of a project's life. This includes annual operating and maintenance costs based on the number of service kilometres performed.
Summary of benefits and costs of the light rail proposal

A summary of the discounted benefits and costs of the light rail proposal (incremental to the Base Case) is presented in Table 9 below, using the discount rates of four percent, seven per cent and ten per cent.

Table 9: Incremental benefits and costs in the economic appraisal ($’millions)

<table>
<thead>
<tr>
<th></th>
<th>4% Discount Rate $m</th>
<th>7% Discount Rate $m</th>
<th>10% Discount Rate $m</th>
<th>Proportion of benefits / costs (%) $m</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cost</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capex</td>
<td>$1,612.57</td>
<td>$1,344.55</td>
<td>$1,146.29</td>
<td>81.61%</td>
</tr>
<tr>
<td>Opex</td>
<td>$578.80</td>
<td>$302.90</td>
<td>$173.84</td>
<td>18.39%</td>
</tr>
<tr>
<td><strong>Total Costs</strong></td>
<td>$2,191.37</td>
<td>$1,647.45</td>
<td>$1,320.13</td>
<td>100.0%</td>
</tr>
<tr>
<td><strong>Benefits</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Highway Savings</td>
<td>$3,210.51</td>
<td>$1,707.59</td>
<td>$995.81</td>
<td>64.15%</td>
</tr>
<tr>
<td>Bus Systems Savings</td>
<td>$1,010.18</td>
<td>$543.82</td>
<td>$320.14</td>
<td>20.43%</td>
</tr>
<tr>
<td>Environmental Cost Savings</td>
<td>$56.87</td>
<td>$34.51</td>
<td>$22.25</td>
<td>1.30%</td>
</tr>
<tr>
<td>Users Consumer Surplus</td>
<td>$739.27</td>
<td>$375.91</td>
<td>$209.11</td>
<td>14.12%</td>
</tr>
<tr>
<td><strong>Total Benefits</strong></td>
<td>$5,016.84</td>
<td>$2,661.83</td>
<td>$1,547.32</td>
<td>100.0%</td>
</tr>
<tr>
<td><strong>Net Benefits</strong></td>
<td>$2,825.47</td>
<td>$1,014.38</td>
<td>$227.18</td>
<td></td>
</tr>
<tr>
<td>Residual Value</td>
<td></td>
<td></td>
<td>$304.01</td>
<td></td>
</tr>
</tbody>
</table>

Notes: Externalities include environmental cost savings incremental to the Base Case.

As indicated in the above table, the residual value in all options remains the same, as this figure is derived by straight line depreciating the actual (undiscounted) acquisition costs for the capital items, as outlined previously. Discounting does not apply in this calculation.
(f) **Wider economic benefits**

This section describes, defines and reports on the expected range of wider economic benefits that the construction of the Canberra Light Rail may generate for society.

‘Wider Economic Benefits’ (WEBs) is an umbrella term for a set of benefits, which are now routinely assessed in Cost-Benefit Analysis (CBA) and for which formal guidance on estimation is provided by the UK Department for Transport. The approach was firstly applied to the Crossrail project in London and the South East. Apart from work undertaken for the East West Link Needs Assessment (EWLNA) in Victoria, WEBs have only recently been captured within CBAs in Australia.

International experience suggests that conventional economic analysis of transport user benefits does not provide a sufficiently full picture of the direct and indirect economic benefits of rail projects. Even in cities with higher population densities (e.g., London and Hong Kong), whilst fare revenues can frequently cover the operating costs of train lines and sometimes maintenance costs, there is often a significant “funding gap” between how much users are prepared to pay (i.e., fare revenue) and the full costs of new lines given the significant construction, and sometimes land acquisition, costs.

This position is strongly articulated in the UK government’s New Approach to Appraisal (NATA) which recognises that traditional transport economic appraisals do not reflect the full value for money of public transport schemes, nor their contribution to wider policy objectives.

Put simply, it is considered that traditional cost-benefit appraisal - for a number of reasons but primarily because of the *absence* of perfect competition in some markets – does not fully reflect the total benefits (as distinct from impacts) of a transport policy or project. WEBs that are traditionally considered in public transport projects include:

- **Move to more productive jobs** – this values the benefits resulting from jobs changing location into for example the CBD or economic clusters which have a higher productivity per worker
- **Agglomeration benefits** – this values the increase in productivity to all existing CBD or cluster jobs resulting from the increase in employment density arising from the transport improvement
- **Increased labour force participation** – this values the increase in the overall number of people working, as a result of the time savings from the transport improvement
- **Imperfect Competition** – this values the efficiency benefits to firms from reduced transport costs, where those benefits are not passed on to customers due to lack of competition.
- **Land capture value** – Any land value increase directly attributable to the light rail results from the improved access and connectivity that light rail would provide and hence this is captured in the transit time savings. To include any financial uplift directly in the model would be a double count.
Benefit analysis results: WEBs

While there is little doubt of the existence of wider economic benefits associated with the light rail proposal at this early stage, any estimate of the magnitude of the WEBs would be subject to a high level of uncertainty.

Preliminary analysis does indicate that the project would generate agglomeration impacts but to a reasonably moderate level given the location of routes and the current Canberra lay out.

There will be some labour supply impacts through improved access to CBD however the magnitude of the impacts will be determined by the change in residential density along the outer sections of the alignment and extent of mode-shift.

Analysis of economic model

On the basis of the methodology and approach outlined above the detailed costs and benefits associated with the light rail proposal were estimated. What follows is an analysis of the individual components that make up the costs and benefits.

Project Costs

The indicative total costs of the project are approximately $3.2 billion over the thirty year period. This includes capital costs, rolling stock costs and operating costs. The profile of these three aspects as a proportion of total expenditure in any given year is presented in Figure 20 below and demonstrates the track costs being incurred during the first four years of the project.

Operating Costs

Typically operating costs include salaries, repairs and maintenance and utilities.
The indicative total capital costs of the project total approximately $2,019.53 billion, and include such things as track costs, road works and vehicle purchase. The following charts illustrate the proportions these, and other major components of capital expenditure are of the total capital spend. As can be seen, track costs, vehicle costs, bridge structures, road works, depots and communication and control systems account for over half the total capital expenditure.
Project Benefits

The project benefits can be broken down into a number of components, as outlined in the Figure 22 below, but generally relate to either highway savings, bus savings or environmental savings. Vehicle operating costs, bus operating costs and fleet operating costs represent the three largest contributors to the overall benefits of the project, while time costs, from both a highway saving and bus saving continue to rise throughout the evaluation period.

Highway savings present a significant benefit to the project, and are presented in the chart below on a NPV basis (using the mid-point discount rate of seven per cent). As can be seen the major drivers of benefits are the savings in vehicle operating costs, time saved and savings as a result of reduced accidents.
There are also significant savings to be realised in the bus system, which reflect in large part the transference of passengers from the bus system to the light rail system as they experience a system which is beneficial to them on one or more criteria. Most of these savings are in the reduced operating requirements as well as the reduced need to purchase additional fleet.

The third major area of benefit realised by the light rail proposal is environmental cost savings, predominantly through the reduction experienced in air pollution which reflects the superior environmental credentials of light rail versus current public transport systems and private transport options. The NPV of the environmental savings are presented in Figure 25 below (based on the mid point discount rate of seven per cent).
(g) Non-monetised benefits

This section of the report discusses the non-monetised benefits associated with the light rail proposal.

The light rail proposal will not only produce monetised benefits, it will also provide other important but difficult to measure benefits. The Victoria Transport Policy Institute has identified non-monetised benefits associated with light rail transport. These are discussed below with reference to an ACT light rail system.

Better service quality

Rail transit tends to provide better service quality than other forms of public transport and attracts more passengers. In particular, studies have shown that discretionary users are more likely to use rail transit rather than any other form of public transport\(^27\).

In addition, due to the controlled acceleration and braking and curve easement, rail transport provides a smoother ride than road use by buses.

---

\(^27\) Litman, T 2004. *Rail Transit in America a comprehensive evaluation of benefits*, Victoria Transport Policy Institute, Melbourne
While some of these benefits manifest themselves through the patronage and subsequently the benefits that are able to be monetised, aspects of increased service are inherently difficult to estimate.

More suitable for high density areas

Rail is able to carry more passengers per vehicle which reduces costs, requiring less land per peak passenger-trip compared with buses. Accordingly, rail is more suitable for high density areas of Canberra.

Increases in property value and economic productivity

Rail transit land use patterns can increase property values and economic productivity by improving accessibility, reducing costs, improving liveability and providing economies of agglomeration. This generally does not occur with bus services given their lack of permanency as an infrastructure asset.

Higher quality service and greater long-run value

Rail transit can be compared to a luxury vehicle; it costs more initially but provides higher quality service and greater long-run value. As consumers become wealthier, as is the case in Canberra, which already has the highest median income of all Australian cities, and accustomed to higher quality goods and services they demand features such as more leg room (and therefore better ability to read, converse and rest) and better travel speed associated with rail transit.

Increased speed in loading and travel

Rail cars have multiple entrances which allow faster loading than buses which typically only have one entrance. This combined with faster acceleration and breaking allows rail to maintain higher overall speeds than buses.

While time savings can be estimated, based on attributing generally agreed values, there are also non-quantifiable benefits to the reduced time taken to travel between two points such as reduced anxiety.

Adaptability of rail

Rail can readily adapt to the number of passengers by adding additional cars during peak hours and removing cars during off peak hours, without the need for additional drivers. In contrast, buses, can not be adapted to suit the number of users.
Solution assessment

Emergency services can use rail track

Emergency services vehicles can use the rail tracks in emergency situation to avoid traffic thus increasing their response time.

Visibly appealing

Rail transport does not suffer the image problem that buses typically do. Unlike buses, rail transport is popular with a wider spectrum of consumers, including people of high income commuters who often shun buses.

Readily identifiable routes

As rail tracks are visible it is easy for potential users to know exactly where the routes, unlike buses where it may be difficult to find a bus and the route.

Social inclusion

Light rail would provide better transport accessibility for Canberrans, particularly those who currently have poor transport access. Transport plays a key role in keeping communities connected, in ensuring that people have access to employment, education and cultural facilities. Conversely poor transport links can result in isolation, unemployment, poor quality of life and increasing inequality.
(h) Preliminary results of the appraisal

This section of the report presents the findings of the limited EA conducted on the light rail proposal. It also presents the results of limited sensitivity analysis undertaken on a selection of key assumptions.

Cost benefit analysis results

The benefits and costs described in the preceding section are aggregated over the evaluation period to yield the incremental total benefits and costs below in Table 10. Full cost and benefit results over the life of the appraisal have been discussed previously and are also detailed in Appendix B.

Table 10: Summary of constrained EA results (discounted at 7%)

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Incremental PV ($ million)</th>
<th>Total Benefits</th>
<th>Total Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canberra Light Rail</td>
<td>$2,661.83</td>
<td>$1,647.45</td>
<td></td>
</tr>
</tbody>
</table>

The benefits and costs of the light rail proposal incremental to the Base Case are used to derive the key economic appraisal indicators presented in Table 11.

Table 11: Economic appraisal indicators (discounted at 7%)

<table>
<thead>
<tr>
<th>Scenario</th>
<th>NPV ($'000s)</th>
<th>NPVI</th>
<th>IRR</th>
<th>BCR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canberra Light Rail</td>
<td>$1,014.38</td>
<td>0.62</td>
<td>14.92%</td>
<td>1.62</td>
</tr>
</tbody>
</table>

When interpreting these results it is important to remember that these do not reflect an exact point estimate of true economic benefit; rather they represent the midpoint of a range of economic benefits as determined by a discount rate of seven per cent. It should also be recognised that cost benefit analysis, by its very nature, cannot be regarded as an exact science and the conclusions arrived at in many cases will, of necessity, be subjective and dependent on the exercise of individual judgement. In many instances, this subjectivity can be expressed as the costs and benefits occurring within a range which is manifested through adjusting the discount rate applied. In this regard, and consistent with Infrastructure Australia guidelines, all costs and benefits have been expressed in present value based on a range of discount factors between four per cent and ten per cent, with a mid point of seven per cent.
Sensitivity analysis

Sensitivities undertaken on the results for the light rail proposal include:

1. Changes in fixed infrastructure costs (+/-20%)
2. Changes in recurrent costs (+/-20%)
3. Changes in the VOC savings (+/-25%)
4. Changes in the time savings (+/- 25%)

<table>
<thead>
<tr>
<th>Sensitivity</th>
<th>BCR</th>
<th>NPV</th>
<th>IRR</th>
<th>NPVI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capital Costs</td>
<td>+ 20%</td>
<td>$702.56</td>
<td>12.32%</td>
<td>0.36</td>
</tr>
<tr>
<td></td>
<td>- 20%</td>
<td>$1,296.29</td>
<td>18.45%</td>
<td>0.95</td>
</tr>
<tr>
<td>Recurrent Costs</td>
<td>+ 20%</td>
<td>$786.41</td>
<td>13.98%</td>
<td>0.42</td>
</tr>
<tr>
<td></td>
<td>- 20%</td>
<td>$1,128.76</td>
<td>15.49%</td>
<td>0.74</td>
</tr>
<tr>
<td>VOC Savings</td>
<td>+ 25%</td>
<td>$1,258.10</td>
<td>16.29%</td>
<td>0.76</td>
</tr>
<tr>
<td></td>
<td>- 25%</td>
<td>$836.78</td>
<td>13.84%</td>
<td>0.51</td>
</tr>
<tr>
<td>Value of Travel Time</td>
<td>+ 25%</td>
<td>$1,731.26</td>
<td>18.53%</td>
<td>1.05</td>
</tr>
<tr>
<td></td>
<td>- 25%</td>
<td>$497.29</td>
<td>11.79%</td>
<td>0.30</td>
</tr>
</tbody>
</table>

As can be seen in the above table, the BCR, NPV and NPVI can be dramatically impacted by adjustments to the capital or recurrent cost estimates (+/- 20 per cent) as well as movements in the key benefits of VOC savings and value of time travel.

It should be noted that, consistent with generally accepted principles of sensitivity analysis, in the above cases the movements identified are applied to the undiscounted cost or benefit projections on a year by year basis. That is capital costs are increased in each year by 20 per cent in the first sensitivity presented above.

Conclusion

In conclusion, the economic analysis has indicated that the light rail proposal returns a positive BCR and positive NPV against the range of discount factors applied. This means that society will be positively benefited by the completion of this project.

It should also be noted that any deferral regarding this project will necessarily increase the BCR calculations as the base case will worsen in terms of such things as congestion, meaning the difference between the base case and the light rail proposal will increase over time.
Solution assessment

It should also be noted that no financial viability analysis has been undertaken in relation to this project, as it is not requested under the Infrastructure Australia guidelines. It is likely however that a financial viability would present significantly different results to an economic cost benefit analysis.
## Appendix A  Infrastructure Australia’s audit framework

<table>
<thead>
<tr>
<th>Stage</th>
<th>Summary</th>
</tr>
</thead>
</table>
| **Goal Definition**    | To ensure a strategic and coordinated approach to transport planning, this project focuses on the economic, environmental and social goals of the ACT. These economic, environmental and social goals have been strategically identified and outlined in the Canberra Plan and subsidiary plans on climate change, skilled labour and transport.  
For Australia to lead the world in economic, sustainable social and environmental policy, then Australia’s capital city must be above reproach and be a leading example not only in Australia but the rest of the world.  
Australia cannot lead the world in policy to reduce the impact and severity of climate change if its national capital has amongst the highest carbon emissions per capital of any city in the world. |
| **Problem Identification** | The ACT community and the ACT Government are working hard to achieve the goals outlined in the Canberra Plan and the more detailed plans that support it. However, to achieve these goals there is a need for Canberra’s transport system to be sustainable. As identified in the ACT Sustainable Transport Plan, Canberra’s current transport system is not sustainable because of the following two issues:  
- Canberra’s carbon emissions from passenger car transport per capita is the highest of any state in Australia; and  
- Growing levels of congestion which are projected to increase are imposing a cost on the ACT community in economic, environmental and social terms and these costs will grow.  
Without appropriate intervention and a coordinated strategic plan Canberra’s transport environment and traffic is destined to resemble those currently being experienced in other Australian capital cities. In the context of congestion, this proposal, is therefore, not about “fixing” the problem but it is about “avoiding” the problem.  
As Australia is seeking to lead the world in policy to reduce the severity of climate change, it follows that Australia’s capital city should also take action. Reducing carbon emissions from passenger motor vehicles is one of the ways to achieve this given that Canberra does not have any heavy industry.  
The ACT already has the lowest unemployment rate of any state or territory in Australia. If Canberra cannot resolve its unsustainable transport problems, the ACT economy and the maintenance of a high quality Australian public sector to administer a range of key government functions are at risk. |
| **Problem Assessment**  | The ACT will be impacted severely by climate change. These impacts include:  
- Hot days and fewer cold nights  
- More frequent droughts  
- Increase in temperature related illness and death  
- Increase in food and water borne diseases  
- Increase in vector borne diseases |
<table>
<thead>
<tr>
<th>Stage</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Injury, trauma and related effects from an increase in extreme weather conditions</td>
</tr>
<tr>
<td></td>
<td>The ACT and more particular the Australian Public Service are having difficulty attracting skilled labour to manage the Australian economy and functions of the government. If Canberra cannot resolve its unsustainable transport problems, the ACT economy and the maintenance of a high quality Australian public sector to administer a range of key government functions are at risk.</td>
</tr>
<tr>
<td>Problem Analysis</td>
<td>Canberra’s heavy car reliance, low density and low public transport use means that changing commuting modes and patterns offers the greatest opportunity to achieve significant improvements in the per capita carbon emissions of Canberrans and thus improve the sustainability of transport in the city.</td>
</tr>
<tr>
<td>Option Generation</td>
<td>As the ACT Government is currently in caretaker mode and due to the tight timeframe imposed by Infrastructure Australia, the ACT Government has been unable to undertake a cost benefit analysis of all the options available to create sustainable transport in the ACT. However, a small number of potential solutions have been identified. These include:</td>
</tr>
<tr>
<td></td>
<td>• Development of more roads</td>
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<td>• Increase in buses on the existing network</td>
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<td></td>
<td>• Develop dedicated bus lanes</td>
</tr>
<tr>
<td></td>
<td>• Develop light rail system in coordination with a bus feeder service</td>
</tr>
<tr>
<td></td>
<td>• Develop rapid transit bus system</td>
</tr>
<tr>
<td></td>
<td>• Increase parking charges</td>
</tr>
<tr>
<td></td>
<td>• Introduce congestion taxes</td>
</tr>
<tr>
<td></td>
<td>• Increase urban infill</td>
</tr>
<tr>
<td>Solution Assessment</td>
<td>The solution to Canberra’s unsustainable transport problem is the development of a light rail network. Light rail will assist Canberra in achieving the goals set out in the ACT Sustainable Transport Plan. Specifically, it will result in a transport system that has lower overall costs, particularly greenhouse gas emissions, lower air pollution, reduced accidents and lower health costs and provides more transport options for the community. The transport system will also support the achievement of economic and social goals for Canberra. The economic appraisal framework used to appraise the economic viability of an ACT light rail system is based on generalised multimodal cost benefit analysis (CBA) methodology. Like all CBA frameworks, the multimodal approach requires the appraisal of projects on an incremental basis, ie comparing the Project Case to the Base Case. The cost benefit analysis undertaken on an ACT light rail system indicated a positive economic net benefit (that is a benefit cost ratio (BCR) of greater than one) against all three discount rates prescribed by Infrastructure Australia, with a mid-point BCR (based on a 7% discount rate) of 1.62.</td>
</tr>
</tbody>
</table>
**Appendix B  Summary of initiative profiling**

**Part A – Overview**

**Title of Initiative**

ACT Light Rail

**Summary of Initiative**

The ACT Government is seeking funding to provide for a light rail system in Canberra to assist in meeting its goals of economic development, sustainability and social inclusion as outlined in the Canberra Plan.

Canberra's existing transport system is not sustainable from an environmental, economic and social perspective and is already imposing significant costs on the ACT economy and society.

The development of the ACT light rail system will result in lower overall costs than the ACT’s current transport system, particularly lower greenhouse gas emissions, lower air pollution, reduced accidents costs and lower health costs and will provides more transport options for the community. The transport system will also support the achievement of the economic and social goals for Canberra as outlined in The Canberra Plan.

This submission follows the format requested by Infrastructure Australia and follows the key steps that Infrastructure Australia will use to determine the Infrastructure Priority List and in doing so is a self audit of the project.

This submission has been prepared on the basis that the light rail network is approximately 54 kilometres in length and consists of 5 routes. The appraisal period for is 30 years, commencing in 2011 and ceasing in 2041. It is based on a 4 year construction period. It has been assumed that the first section will be completed within two years and operations will commence immediately after construction is complete. The capital costs of the project over the appraisal period are $2,019.53 million and the operating costs are $1,221.5 million over the appraisal period.
A cost benefit analysis was undertaken on the Canberra light rail system using 4, 7 and 10% discount rates.

The cost benefit analysis indicated a positive economic net benefit (that is a benefit cost ratio (BCR) of greater than one) against all three discount rates prescribed by Infrastructure Australia, with a mid-point BCR (based on a 7% discount rate) of 1.62.

Other results from the cost benefit analysis of the light rail system (based on a 7% discount rates are as follows:

- Net Present Value (NPV) - $1,014.38 million
- Internal Rate of Return (IRR) – 14.92%
- Net Present Value / Investment Costs (NPVI) – 0.62
### Part B – Rating and Justification

<table>
<thead>
<tr>
<th>Item</th>
<th>Expand Australia’s productive capacity</th>
<th>Increase Australia’s productivity</th>
<th>Diversify Australia’s economic capabilities</th>
<th>Build on Australia’s global competitive advantage</th>
<th>Develop our cities and/or regions</th>
<th>Reduce greenhouse emissions</th>
<th>Improve social, equity and quality of life in our cities and regions</th>
<th>Linkages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rating</td>
<td>Slightly Beneficial</td>
<td>Moderately Beneficial</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Highly Beneficial</td>
<td>Highly Beneficial</td>
<td>Moderately Beneficial</td>
<td></td>
</tr>
<tr>
<td>How does the initiative meet/does not meet the strategic priority?</td>
<td>The development of a light rail system will decrease Canberra’s traffic congestion and people’s commuting time. As a result, Australia’s productivity will increase because the number of hours available for people to work will increase. Refer below for the reasons as to why the number of people’s hours available for work will increase.</td>
<td>Canberra is currently experiencing difficulty in attracting sufficient skilled labour on both a national and international front. The liveability in Canberra is being affected by increasing congestion levels. These two issues are affecting the ACT and the Australian Public Service productivity and productive capacity. Although transport is only one factor that impacts Canberra’s attractiveness as a place to work, it is a factor that people</td>
<td>A light rail system which improves the efficiency of public transport in Canberra can support diversified economic opportunities including education and high technology industries.</td>
<td>Light rail will have only a slight impact on Australia's global competitive advantage. As mentioned previously light rail will increase Canberra’s attractiveness as a place to live and work. This will enhance Canberra’s ability to recruit and retain skilled workers both international and domestically. The recruitment of highly skilled international labour will build on Australia’s global competitive advantage.</td>
<td>Canberra’s current transport system is unsustainable. Canberra has the highest carbon emissions from passenger car transport per capita of any Australian capital city and the growing levels of congestion which are projected to increase are imposing a cost on the ACT community in economic, environmental and social terms. These costs will continue to grow. Therefore, improvements need to be made to the current transport system. A light rail system can assist with this improvement process. Light rail will assist in the development of Canberra</td>
<td>Light rail will reduce private vehicle use and congestion which in turn will reduce greenhouse gas emissions and air pollution.</td>
<td>Canberra’s existing transport system is not sustainable from an environmental, economic and social perspective and is already imposing significant costs on the ACT economy and society. The more time spent by people commuting detracts from time they can spend doing other activities that are not work related but which still have a value to themselves and society.</td>
<td></td>
</tr>
</tbody>
</table>
## Summary of initiative profiling

<table>
<thead>
<tr>
<th>Item</th>
<th>Expand Australia’s productive capacity</th>
<th>Increase Australia’s productivity</th>
<th>Diversify Australia’s economic capabilities</th>
<th>Build on Australia’s global competitive advantage</th>
<th>Develop our cities and/or regions</th>
<th>Reduce greenhouse emissions</th>
<th>Improve social, equity and quality of life in our cities and regions</th>
<th>Linkages</th>
</tr>
</thead>
</table>
|      | consider when deciding where to live and work. Accordingly, light rail will bring public transport service levels closer to those of other Australian capital cities and make it the national capital a more attractive place to live and work. |                              |                                          | and its surrounding region because it:  
• Provides net benefits for the ACT economy by improving the efficiency of the whole transport system, especially by integrating the transport system with land use planning and development  
• Addresses traffic congestion within Canberra central area  
• Improves social outcomes  
• Minimises the level of transport emissions  
• Provides the ACT community with higher quality transport options. |                              |                              |                                           |                              |        |

**Provide data and evidence of how the initiative meets/does:**  
Studies conducted by Bureau of Transport and Regional Economics show that the cost of congestion resulted in business time costs of  
Studies have shown that more time spent by individuals commuting results in them spending less time on other  
N/A  
N/A  
N/A  
Please refer above as to how the ACT light rail will assist in the development of Canberra.  
Transport plays a key role in  
The results from our economic model demonstrate that an ACT  
Efficient transport is essential to equitable access, particularly for the aged, disabled or socially disadvantaged. Mobility is critical to the
Summary of initiative profiling

<table>
<thead>
<tr>
<th>Item</th>
<th>Expand Australia’s productive capacity</th>
<th>Increase Australia’s productivity</th>
<th>Diversify Australia’s economic capabilities</th>
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<th>Improve social, equity and quality of life in our cities and regions</th>
<th>Linkages</th>
</tr>
</thead>
<tbody>
<tr>
<td>$3.6 billion in 2005 nationally. Traffic congestion also reduces the number of hours available to work as people will be required to spend more time travelling, thus reducing Australia’s productive capacity. Light rail will reduce Canberra’s traffic congestion, thus expanding Canberra’s productive capacity.</td>
<td>$3.6 billion in 2005 nationally. Traffic congestion also reduces the number of hours available to work as people will be required to spend more time travelling, thus reducing Australia’s productive capacity. Light rail will reduce Canberra’s traffic congestion, thus expanding Canberra’s productive capacity.</td>
<td>activities. Some of these activities include leisure or community activities. The remaining will manifest in less time spent at work. By improving Canberra’s transport system by implementing light rail there will be a decrease in congestion and commuting time, thus resulting in an increase in the hours available for people to spend at work or other activities that contribute to society. In addition, improved transport systems are central to increasing productivity in a service based economy, such as Canberra, through</td>
<td>keeping communities connected, in ensuring that people have access to employment, education and cultural facilities. Conversely poor transport links can result in isolation, unemployment, poor quality of life and increasing inequality.</td>
<td>light rail system will result in a decrease in greenhouse gas emissions and air pollution.</td>
<td>physical, social and psychological well being of this group and is one factor determining their quality of life. Physical health depends upon access to medical facilities and other social services. The ability to maintain active social networks depends on accessibility to family and friends as well as recreational and cultural activities. Psychological health is enhanced by unrestricted mobility that allows choice of a range of destinations and the attainment of freedom from possible isolation at home. Light rail is a sustainable form of transport that can achieve the above outcomes.</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Item</td>
<td>Expand Australia’s productive capacity</td>
<td>Increase Australia’s productivity</td>
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<td>---------------------------------------------------------------------</td>
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<td>-------------------------------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>Provide an outline of how the initiative is dependent on policy, regulatory, demand, pricing, efficiency and or capital investment initiatives</td>
<td>Demand and pricing are key dependencies of the light rail project in terms of its ability to benefit Australia’s productive capabilities, insofar as the benefits outlined previously are predicated on a particular demand expectation and pricing regime. Adverse impact to either of these assumptions will necessarily have a negative impact on the projected productive capacity benefits.</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>
Appendices C and D Summary of initiative appraisal – Key results and assumptions

Part A – Overview

Title of Initiative
ACT Light Rail

Stakeholder
ACT Government
Department of Territory and Municipal Services

Summary of submission

The ACT Government is seeking funding to provide for a light rail system in Canberra to assist in meeting its goals of economic development, sustainability and social inclusion as outlined in the Canberra Plan.

Canberra’s existing transport system is not sustainable from an environmental, economic and social perspective and is already imposing significant costs on the ACT economy and society.

The development of the ACT light rail system will result in lower overall costs than the ACT’s current transport system, particularly lower greenhouse gas emissions, lower air pollution, reduced accidents costs and lower health costs and will provides more transport options for the community. The transport system will also support the achievement of the economic and social goals for Canberra as outlined in The Canberra Plan.

This submission follows the format requested by Infrastructure Australia and follows the key steps that Infrastructure Australia will use to determine the Infrastructure Priority List and in doing so is a self audit of the project.

This submission has been prepared on the basis that the light rail network is approximately 54 kilometres in length and consists of 5 routes. The
Appendices C and D Summary of initiative appraisal – Key results and assumptions

The appraisal period is for 30 years, commencing in 2011 and ceasing in 2041. It is based on a 4 year construction period. It has been assumed that the first section will be completed within two years and operations will commence immediately after construction is complete. The capital costs of the project over the appraisal period are $2,019.53 million and the operating costs are $1,221.5 million over the appraisal period.

A cost benefit analysis was undertaken on the Canberra light rail system using 4, 7 and 10% discount rates.

The cost benefit analysis indicated a positive economic net benefit (that is a benefit cost ratio (BCR) of greater than one) against all three discount rates prescribed by Infrastructure Australia, with a mid-point BCR (based on a 7% discount rate) of 1.62.

Other results from the cost benefit analysis of the light rail system (based on a 7% discount rates are as follows:

- Net Present Value (NPV) - $1,014.38 million
- Internal Rate of Return (IRR) – 14.92%
- Net Present Value / Investment Costs (NPVI) – 0.62
### B.1 Key assumptions

<table>
<thead>
<tr>
<th>Item</th>
<th>Assumption</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Key drivers</strong></td>
<td>The key assumptions that have been made about future developments that affect the need and likely success of the light rail system are Canberra’s population growth and the cost of traffic congestion. For a full list of key drivers and assumptions made for the purposes of this presentation please refer to the full report and appendix H.</td>
</tr>
<tr>
<td><strong>Base case</strong></td>
<td>The base case scenario represents the existing public transport situation if an ACT light rail is not implemented. Canberra’s existing transport system is not sustainable from an economic development, sustainability and social inclusion as outlined in the Canberra Plan. Without a sustainable transport system Canberra’s perspective carbon emissions from passenger car transport per capita will continue to grow and traffic congestion will impose further costs on the ACT community in economic, environmental and social terms. Without intervention now and a coordinated strategic plan Canberra’s traffic is destined to resemble those currently being experienced in more populous capital cities of Australia. The implementation of the Canberra light rail is a solution that “avoids” the problem.</td>
</tr>
<tr>
<td><strong>First year of construction</strong></td>
<td>Construction will commence in 2011.</td>
</tr>
<tr>
<td><strong>Last year of construction</strong></td>
<td>Construction will take approximately four years. Thus, construction will cease in 2015.</td>
</tr>
<tr>
<td><strong>Discount rate</strong></td>
<td>The discount rates applied are those outlined in the Infrastructure Australia guidelines and include 4%, 7% and 10%.</td>
</tr>
<tr>
<td><strong>Appraisal period</strong></td>
<td>The appraisal period is 30 years starting in 2011 and ending in 2041.</td>
</tr>
</tbody>
</table>
| **Remaining life**          | The economic lives of the infrastructure components are as follows:  
  • Fixed infrastructure (e.g., track) – 100 years  
  • Earthworks and drainage – 40 years  
  • Stations – 50 years  
  • Rail cars – 35 years  
  All assets will be depreciated using a straight line method over their effective life.                                                                 |

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**ACT Light Rail 79**

Proposal to Infrastructure Australia
<table>
<thead>
<tr>
<th>Item</th>
<th>Assumption</th>
</tr>
</thead>
</table>
|      | As the appraisal period for the submission is 30 years the remaining life of the assets at the end of the appraisal period will be as follows:  
  - Fixed infrastructure – 70 years  
  - Earthworks and drainage – 10 years  
  - Stations – 20 years  
  - Rail cars – 15 years |
| Residual value | The residual value of an ACT light rail after the 30 year appraisal period is $304.01 million. The residual value has been calculated by deducting the depreciation (calculated above) from the cost of the asset. The remaining balance was the residual value. |
| Benefit ramp up | The cost benefit analysis has been prepared on the basis that construction will commence in 2011 and will be completed within fours years, thus construction will be completed in 2015. It has been assumed that the first section of the light rail system will be completed within two years and operations will commence immediately. The other four routes will be progressively and constructed over the remaining construction period. The report has been prepared on the basis that the routes will be constructed in the following order:  
  1. Belconnen - Civic  
  2. Gungahlin - Civic  
  3. Civic - Woden  
  4. Woden - Tuggeranong  
  5. Civic - Manuka Loop |
| Capital cost | The capital costs are $2,019.53 million. This comprises of the following items: road works, track works, bridge structures, light rail vehicles, depots, communication control and other costs. |
| Maintenance costs | The maintenance costs associated with the project are included in the $1,221.54 operating costs below. |
| Operating costs | The average operating costs each year of appraisal period are approximately $40.72 million. Accordingly, the total operating costs for the appraisal period are $1,221.54 million. |
| Benefit components | The benefit components provided by an ACT light rail can be expressed in terms of decreases in the following costs:  
  - Congestion  
  - Road maintenance |
### Item

<table>
<thead>
<tr>
<th>Assumption</th>
</tr>
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<tbody>
<tr>
<td>• Accident</td>
</tr>
<tr>
<td>• Vehicle operating</td>
</tr>
<tr>
<td>• Time</td>
</tr>
<tr>
<td>• Bus Fleet</td>
</tr>
<tr>
<td>• Bus operating</td>
</tr>
<tr>
<td>• Bus passenger time</td>
</tr>
<tr>
<td>• Air pollution</td>
</tr>
<tr>
<td>• Greenhouse gas</td>
</tr>
<tr>
<td>• Noise pollution</td>
</tr>
</tbody>
</table>

An ACT light rail will also produce non-monetised benefits please refer to table 4 for details of these benefits.

Please refer to Appendix G which provides a full list of assumptions and parameters used in preparing the economic model for the purposes of this report.

### Cost and benefit time streams

Please refer to Appendix F which shows the time stream for each benefit and cost component expressed in undiscounted 2008 dollars.

### Other

For the full list of assumptions and parameters used in the economic model for this submission please refer to Appendix G.
Appendices C and D Summary of initiative appraisal – Key results and assumptions

B.2 CBA results

Table 12: CBA results

<table>
<thead>
<tr>
<th>Discount Rate (%)</th>
<th>4%</th>
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<tr>
<td>BCR</td>
<td>2.29</td>
<td>1.62</td>
<td>1.17</td>
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<tr>
<td>NPV ($m, 2008 dollars) ie 'Net Benefit'</td>
<td>$2,825.47</td>
<td>$1,014.38</td>
<td>$227.18</td>
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<tr>
<td>NPV / $</td>
<td>1.17</td>
<td>0.62</td>
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<tr>
<td>IRR</td>
<td>14.92%</td>
<td>14.92%</td>
<td>14.92%</td>
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Table 13: Monetised benefits and costs ($m, 2008)

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<th>Monetised costs/benefits</th>
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<td>Capital Cost</td>
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<td>Operating Cost</td>
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<td><strong>COSTS</strong></td>
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<tr>
<td>Highway Savings</td>
<td>$1,707.59</td>
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<td>Bus Systems Savings</td>
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<tr>
<td>Environmental Cost Savings</td>
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<tr>
<td>Users Consumer Surplus</td>
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<tr>
<td><strong>BENEFITS</strong></td>
<td><strong>$2,661.83</strong></td>
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<tr>
<td><strong>Value</strong></td>
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<td><strong>Percentage</strong></td>
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B.3 Sensitivity testing

Table 14: BCR sensitivity testing results

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<th>Sensitivity</th>
<th>Canberra Light Rail</th>
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<tr>
<td></td>
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<tr>
<td>Capital Costs</td>
<td>+ 20%</td>
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<tr>
<td></td>
<td>-20%</td>
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<tr>
<td>Recurrent Costs</td>
<td>+ 20%</td>
</tr>
<tr>
<td></td>
<td>-20%</td>
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</table>
## Canberra Light Rail

<table>
<thead>
<tr>
<th></th>
<th>VOC Savings</th>
<th>Value of Travel Time</th>
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<tr>
<td><strong>+25%</strong></td>
<td>1.76</td>
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<td>$1,258.10</td>
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<td></td>
<td>16.29%</td>
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<tr>
<td><strong>-25%</strong></td>
<td>1.51</td>
<td>1.30</td>
</tr>
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<td></td>
<td>$836.78</td>
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<td></td>
<td>13.84%</td>
<td>11.79%</td>
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</table>
### Part C – Non-monetised benefits and costs

#### Table 15: Non-monetised benefits and costs

<table>
<thead>
<tr>
<th>Cost/Benefit</th>
<th>Description</th>
<th>Rating</th>
</tr>
</thead>
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<tr>
<td><strong>Better Service Quality</strong></td>
<td>Rail transit provides better service quality than other forms of public transport. Rail transit attracts more passengers than bus services. Due to controlled acceleration and braking and curve easement, rail transport provides a smoother ride than buses.</td>
<td>Highly beneficial</td>
</tr>
<tr>
<td><strong>More Suitable for High Density Areas</strong></td>
<td>Rail is able to carry more passengers per vehicle than buses thus requiring less land per peak passenger-trip. This results in rail being more appropriate for higher density areas such as Canberra.</td>
<td>Highly beneficial</td>
</tr>
<tr>
<td><strong>Increases property value and economic productivity</strong></td>
<td>Rail transit land use patterns can increase property values and economic productivity by improving accessibility, reducing costs, improving liveability and providing economies of agglomeration.</td>
<td>Highly beneficial</td>
</tr>
<tr>
<td><strong>High Quality Service and Greater Long-Run Value</strong></td>
<td>Rail transit can be compared to a luxury vehicle. It costs more initially but provides higher quality service and great long-run value. As consumers become wealthier (particularly in the Canberra market which already has the highest median wealth per capita of any Australian capital city) and accustomed to higher quality goods and services they demand features such as more leg room and travel speed associated directly with rail transport.</td>
<td>Highly beneficial</td>
</tr>
<tr>
<td><strong>Increased Speed in Loading and Travel</strong></td>
<td>Rail cars have multiple entrances which allow faster loading than buses which only have one entrance.</td>
<td>Moderately beneficial</td>
</tr>
<tr>
<td>Cost/Benefit</td>
<td>Description</td>
<td>Rating</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>Adaptability of Rail</td>
<td>Rail transport can readily adapt to the number of passengers by adding additional cars during peak hours and removing cars during peak off hours, resulting in no additional drivers.</td>
<td>Moderately beneficial</td>
</tr>
<tr>
<td>Emergency Services Can Use Rail Track</td>
<td>Emergency services vehicles can use the tail tracks in an emergency situation to avoid traffic thus increasing their response time.</td>
<td>Moderately beneficial</td>
</tr>
<tr>
<td>Visibly Appealing</td>
<td>Rail transport does not suffer the same image problem that buses do. Rail is popular with a broad spectrum of consumers, including high income commuters who often shun buses.</td>
<td>Slightly beneficial</td>
</tr>
<tr>
<td>Readily Identifiable Routes</td>
<td>As rail tracks are visible it is easy for potential users to know exactly where the routes are.</td>
<td>Slightly beneficial</td>
</tr>
</tbody>
</table>

**Part E – Information sources**

Please refer to the reference list on page 95 for the information sources used to produce this report.
## Appendix F  Cost and Benefit Time Streams

<table>
<thead>
<tr>
<th>Year</th>
<th>Track Cost</th>
<th>Depots</th>
<th>Rolling Stock</th>
<th>Operating Costs</th>
<th>Deconstruction Costs</th>
<th>Maintenance Costs</th>
<th>Accident Costs</th>
<th>V.O.C. Costs</th>
<th>Time Costs</th>
<th>Fleet Cost</th>
<th>Operating Cost</th>
<th>Passenger Time</th>
<th>Air Pollution</th>
<th>Greenhouse Gas</th>
<th>Noise Pollution</th>
<th>Consumer Surplus</th>
<th>Net Flow</th>
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<td>$1.21</td>
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</table>
## Appendix F  Cost and Benefit Time Streams

### Cost and Benefits Time Streams (2008, $million)

<table>
<thead>
<tr>
<th>Year</th>
<th>LRT System</th>
<th>Highway Savings</th>
<th>Bus System Savings</th>
<th>Environmental Cost Savings</th>
<th>Users</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Track Cost</td>
<td>Depots</td>
<td>Rolling Stock</td>
<td>Operating Costs</td>
<td>Decongestion Costs</td>
</tr>
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<tr>
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<td>0.00</td>
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<td>2032</td>
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</tr>
<tr>
<td>2035</td>
<td>0.00</td>
<td>0.00</td>
<td>14.52</td>
<td>52.91</td>
<td>0.00</td>
</tr>
<tr>
<td>2036</td>
<td>0.00</td>
<td>0.00</td>
<td>15.04</td>
<td>54.11</td>
<td>0.00</td>
</tr>
<tr>
<td>2037</td>
<td>0.00</td>
<td>0.00</td>
<td>15.56</td>
<td>55.31</td>
<td>0.00</td>
</tr>
<tr>
<td>2038</td>
<td>0.00</td>
<td>0.00</td>
<td>16.08</td>
<td>56.51</td>
<td>0.00</td>
</tr>
<tr>
<td>2039</td>
<td>0.00</td>
<td>0.00</td>
<td>16.60</td>
<td>57.71</td>
<td>0.00</td>
</tr>
<tr>
<td>2040</td>
<td>0.00</td>
<td>0.00</td>
<td>17.12</td>
<td>58.92</td>
<td>0.00</td>
</tr>
<tr>
<td>2041</td>
<td>0.00</td>
<td>0.00</td>
<td>17.63</td>
<td>60.12</td>
<td>0.00</td>
</tr>
</tbody>
</table>
Appendix G  Economic model notes and assumptions

The economic model used for the purposes of this report was prepared using the following parameter values and assumptions.

Staging of the Light Rail System

The model has been prepared on the basis that construction of an ACT light rail will commence in the year 2011 and that it will be fully completed in four years. It has been assumed that the first section will be completed within two years and operations will commence immediately after construction is complete. For the purposes of this report the routes will be constructed in the following order:

1. Belconnen → Civic
2. Gungahlin → Civic
3. Civic → Woden
4. Woden → Tuggeranong
5. Civic → Manuka Loop

Light Rail Capital and Operating Costs

The capital and operating costs have been sourced from Kellogg Brown & Root Pty Ltd’s 2004 Canberra Public Transport Futures and Feasibility Study Final Report: Economic Implications of Transport Options. The base year for the capital costs presented in Appendix E was June 2003 as a result the costs have been indexed using the Australian Bureau of Statistics’ Output of Construction Industry index to the base year of 2008.

Costs not included in the Model

The following items have not been included in the cost estimates included in the model:

- Driver training
- Land acquisition costs (all land assumed in government ownership)
- Government/Client costs
- Maintenance/warranty period costs

Again, this is consistent with the approach taken in the Kellogg Brown & Root Pty Ltd study.

Light Rail Ticketing System

Based on our discussion with the Department of Territory and Municipal Services officials on 28 October 2008 the ticketing system has an estimated cost of $10 million.
Appendix G  Economic model notes and assumptions

Annual Trips

The number of trips is calculated based on an AM peak observation.

Generalised Costs – Perceived Costs

In-vehicle time

The standard value of in-vehicle time for public transport users in Canberra is $13.00 per passenger per hour. This figure is based on rates produced by the Australian Transport Council (ATC) and has been adjusted for the Canberra market.

Vehicle on Costs

The standard value of vehicle on costs is $0.29 per vehicle kilometre travelled. This value includes $0.15 fuel costs and $0.14 of other perceived costs including maintenance and depreciation.

Vehicle Operating Costs – Resource Costs

The resource costs for cars and trucks are as shown in the table below.

<table>
<thead>
<tr>
<th>Type of Vehicle</th>
<th>Cost per vehicle kilometre ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Car</td>
<td>0.45</td>
</tr>
<tr>
<td>Bus</td>
<td>2.85</td>
</tr>
</tbody>
</table>

Average Fare Price

The ticket price used to calculate fare revenue is $2.40. The average fare has been calculated based on a weighted average of the various tickets sold (including cash ticket, fare-saver ticket, daily, weekly and monthly tickets) over a 12 month period.

Car Occupancy

The car occupancy rate is 1.36 people. This rate has been calculated using the average car occupancy rates for various types of car travel (such as work, education, shopping, personal business and recreation).

Environment Costs

The environment cost values are as shown in the table below. These figures are based on statistics produced by RailCorp.28

28 RailCorp 2008, A Compendium of CityRail Travel Statistics – Sixth Edition
Appendix G  Economic model notes and assumptions

<table>
<thead>
<tr>
<th></th>
<th>Rail ($ per vehicle km)</th>
<th>Bus ($ per vehicle km)</th>
<th>Car ($ per vehicle km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Pollution</td>
<td>0.0396</td>
<td>0.2861</td>
<td>0.0254</td>
</tr>
<tr>
<td>Greenhouse Gas</td>
<td>0.0064</td>
<td>0.1179</td>
<td>0.0200</td>
</tr>
<tr>
<td>Noise Pollution</td>
<td>0.0204</td>
<td>0.0526</td>
<td>0.2599</td>
</tr>
</tbody>
</table>

Bus operating costs, vehicle costs and replacement period

The table below shows the bus operating costs per kilometre, each vehicle cost and the replacement period.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Cost per kilometre</td>
<td>$4.15</td>
</tr>
<tr>
<td>Vehicle Cost</td>
<td>$240,000</td>
</tr>
<tr>
<td>Replacement Period</td>
<td>15 years</td>
</tr>
</tbody>
</table>

Average Speed of Vehicles

The average speed for Canberra buses and light rail are as shown in the following table. These figures have been sourced from statistics produced by ACTION.

<table>
<thead>
<tr>
<th>Type of vehicle</th>
<th>Average Speed (kilometres per hour)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bus</td>
<td>40.7</td>
</tr>
<tr>
<td>Light Rail</td>
<td>43.6</td>
</tr>
</tbody>
</table>

Transit Time Costs

The transit user time cost is calculated using the following formula:

Transit trips * (average transit cost – average fare) * (resource time cost / perceived time costs)

Maintenance Costs

The maintenance costs consist of three different components. These include:

1. Fixed costs per lane per kilometre
2. Variable cost which differ with total traffic per lane per kilometre
3. Variable cost which differ with total axle-loads per lane per kilometre.

Decongestion Costs

The decongestion costs are based on a rate of $0.54 per vehicle kilometre travelled. This rate is derived from weighting the base value of $0.46/car kilometre against the differing values of travel time for the vehicle classes and the compositions of these on urban roads.
Appendix G Economic model notes and assumptions

Accident Costs

The accident costs are as shown in the table below. These costs have been calculated using ACT accident data and are based on the number of accidents in Canberra over a ten year period, the types of injury and damage sustained (for example fatalities, injuries and property damage) and the road type (for example, local, collector and arterial).

<table>
<thead>
<tr>
<th>Type of Injury</th>
<th>Cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fatal</td>
<td>$1,870,585</td>
</tr>
<tr>
<td>Injury</td>
<td>$150,000</td>
</tr>
<tr>
<td>Property Damage (only)</td>
<td>$17,518</td>
</tr>
</tbody>
</table>
Appendix H References

References


ABS 2006, *Canberra… A Social Atlas*, cat no. 2030.8, ABS, Canberra

ABS 2004, Consumer Price Index, cat no. 6401.0, ABS, Canberra


ABS 2007, Producer Prices Index, cat no. 6427.0, ABS, Canberra


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Department of Transport and Regional Services (DTRS) 2005, Health Impacts of Transport Emissions in Australia: Economic Costs, working paper, no 63, DTRS, Canberra
Department of Transport and Regional Services Bureau of Transport and Regional Economics 2007 - Estimating urban traffic and congestion cost trends for Australian cities, working paper, no 71, DTRS, Canberra

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