



08 Appendices

Appendix A Infrastructure Australia’s audit framework

Stage	Summary
Goal Definition	<p>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.</p> <p>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.</p> <p>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.</p>
Problem Identification	<p>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:</p> <ul style="list-style-type: none"> • 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. <p>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.</p> <p>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.</p> <p>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.</p>
Problem Assessment	<p>The ACT will be impacted severely by climate change. These impacts include:</p> <ul style="list-style-type: none"> • 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

Stage	Summary
	<ul style="list-style-type: none"> • Injury, trauma and related effects from an increase in extreme weather conditions <p>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.</p>
Problem Analysis	<p>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.</p>
Option Generation	<p>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.</p> <p>However, a small number of potential solutions have been identified. These include:</p> <ul style="list-style-type: none"> • Development of more roads • Increase in buses on the existing network • Develop dedicated bus lanes • Develop light rail system in coordination with a bus feeder service • Develop rapid transit bus system • Increase parking charges • Introduce congestion taxes • Increase urban infill
Solution Assessment	<p>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.</p> <p>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.</p> <p>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.</p>

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.

Summary of initiative profiling

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

Item	Expand Australia's productive capacity	Increase Australia's productivity	Diversify Australia's economic capabilities	Build on Australia's global competitive advantage	Develop our cities and/or regions	Reduce greenhouse emissions	Improve social, equity and quality of life in our cities and regions	Linkages
Rating	Slightly Beneficial	Moderately Beneficial	Neutral	Neutral	Highly Beneficial	Highly Beneficial	Moderately Beneficial	
How does the initiative meet/does not meet the strategic priority?	<p>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.</p>	<p>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</p> <p>Although transport is only one factor that impacts Canberra's attractiveness as a place to work, it is a factor that people</p>	<p>A light rail system which improves the efficiency of public transport in Canberra can support diversified economic opportunities including education and high technology industries.</p>	<p>Light rail will have only a slight impact on Australia's global competitive advantage.</p> <p>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.</p>	<p>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.</p> <p>Light rail will assist in the development of Canberra</p>	<p>Light rail will reduce private vehicle use and congestion which in turn will reduce greenhouse gas emissions and air pollution.</p>	<p>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.</p> <p>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.</p>	

Summary of initiative profiling

Item	Expand Australia's productive capacity	Increase Australia's productivity	Diversify Australia's economic capabilities	Build on Australia's global competitive advantage	Develop our cities and/or regions	Reduce greenhouse emissions	Improve social, equity and quality of life in our cities and regions	Linkages
		<p>consider when deciding where to live and work.</p> <p>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.</p>			<p>and its surrounding region because it:</p> <ul style="list-style-type: none"> • 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	<p>Please refer above as to how the ACT light rail will assist in the development of Canberra.</p> <p>Transport plays a key role in</p>	The results from our economic model demonstrate that an ACT	Efficient transport is essential to equitable access, particularly for the aged, disable or socially disadvantaged. Mobility is critical to the	

Summary of initiative profiling

Item	Expand Australia's productive capacity	Increase Australia's productivity	Diversify Australia's economic capabilities	Build on Australia's global competitive advantage	Develop our cities and/or regions	Reduce greenhouse emissions	Improve social, equity and quality of life in our cities and regions	Linkages
not meet the strategic priority	<p>\$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.</p> <p>Light rail will reduce Canberra's traffic congestion, thus expanding Canberra's productive capacity.</p>	<p>activities. Some of these activities include leisure or community activities. The remaining will manifest in less time spent at work.</p> <p>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.</p> <p>In addition, improved transport systems are central to increasing productivity in a service based economy, such as Canberra, through</p>			<p>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.</p>	<p>light rail system will result in a decrease in greenhouse gas emissions and air pollution.</p>	<p>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.</p> <p>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.</p> <p>Light rail is a sustainable form of transport that can achieve the above outcomes.</p>	

Summary of initiative profiling

Item	Expand Australia's productive capacity	Increase Australia's productivity	Diversify Australia's economic capabilities	Build on Australia's global competitive advantage	Develop our cities and/or regions	Reduce greenhouse emissions	Improve social, equity and quality of life in our cities and regions	Linkages
		their potential to develop deep, flexible labour markets that permit higher levels of specialisation and flexibility.						
Provide an outline of how the initiative is dependent on policy, regulatory, demand, pricing, efficiency and or capital investment initiatives	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.	Consistent with the productive capacity benefits of an ACT light rail system, user demand and pricing are also key dependencies upon which productivity benefits are founded.	N/A	N/A				

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

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

Part B – Cost Benefit Analysis (CBA) – Monetised Benefits and Costs

B.1 Key assumptions

Item	Assumption
Key drivers	<p>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.</p> <p>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.</p>
Base case	<p>The base case scenario represents the existing public transport situation if an ACT light rail is not implemented.</p> <p>Canberra’s existing transport system is not sustainable from an economic development, sustainability and social inclusion as outlined in the Canberra Plan.</p> <p>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.</p> <p>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.</p>
First year of construction	Construction will commence in 2011.
Last year of construction	Construction will take approximately four years. Thus, construction will cease in 2015.
Discount rate	The discount rates applied are those outlined in the Infrastructure Australia guidelines and include 4%, 7% and 10%.
Appraisal period	The appraisal period is 30 years starting in 2011 and ending in 2041.
Remaining life	<p>The economic lives of the infrastructure components are as follows:</p> <ul style="list-style-type: none"> • Fixed infrastructure (eg track) – 100 years • Earthworks and drainage – 40 years • Stations – 50 years • Rail cars – 35 years <p>All assets will be depreciated using a straight line method over their effective life.</p>

Item	Assumption
	<p>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:</p> <ul style="list-style-type: none"> • Fixed infrastructure – 70 years • Earthworks and drainage – 10 years • Stations – 20 years • Rail cars – 15 years
Residual value	<p>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.</p>
Benefit ramp up	<p>The cost benefit analysis has been prepared on the basis that construction will commence in 2011 and will be completed within four years, thus construction will be completed in 2015.</p> <p>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.</p> <p>The report has been prepared on the basis that the routes will be constructed in the following order:</p> <ol style="list-style-type: none"> 1. Belconnen - Civic 2. Gungahlin - Civic 3. Civic - Woden 4. Woden - Tuggeranong 5. Civic - Manuka Loop
Capital cost	<p>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.</p>
Maintenance costs	<p>The maintenance costs associated with the project are included in the \$1,221.54 operating costs below.</p>
Operating costs	<p>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.</p>
Benefit components	<p>The benefit components provided by an ACT light rail can be expressed in terms of decreases in the following costs:</p> <ul style="list-style-type: none"> • Congestion • Road maintenance

Item	Assumption
	<ul style="list-style-type: none"> • Accident • Vehicle operating • Time • Bus Fleet • Bus operating • Bus passenger time • Air pollution • Greenhouse gas • Noise pollution <p>An ACT light rail will also produce non-monetised benefits please refer to table 4 for details of these benefits.</p> <p>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.</p>
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.

B.2 CBA results

Table 12: CBA results

	Discount Rate (%)		
	4%	7%	10%
BCR	2.29	1.62	1.17
NPV (\$m, 2008 dollars) ie 'Net Benefit'	\$2,825.47	\$1,014.38	\$227.18
NPV / \$	1.17	0.62	0.17
IRR	14.92%	14.92%	14.92%

Table 13: Monetised benefits and costs (\$m, 2008)

Monetised costs/benefits	Cost	
Capital Cost	\$1,344.55	
Operating Cost	\$302.90	
COSTS	\$1,647.45	
	Value	Percentage
Highway Savings	\$1,707.59	64.15%
Bus Systems Savings	\$543.82	20.43%
Environmental Cost Savings	\$34.51	1.30%
Users Consumer Surplus	\$375.91	14.12%
BENEFITS	\$2,661.83	100.00%

B.3 Sensitivity testing

Table 14: BCR sensitivity testing results

		Canberra Light Rail			
Sensitivity		BCR	NPV	IRR	NPVI
Capital Costs	+ 20%	1.36	\$702.56	12.32%	0.36
	-20%	1.95	\$1,296.29	18.45%	0.95
Recurrent Costs	+ 20%	1.42	\$786.41	13.98%	0.42
	-20%	1.74	\$1,128.76	15.49%	0.74

Canberra Light Rail					
VOC Savings	+25%	1.76	\$1,258.10	16.29%	0.76
	-25%	1.51	\$836.78	13.84%	0.51
Value of Travel Time	+ 25%	2.05	\$1,731.26	18.53%	1.05
	-25%	1.30	\$497.29	11.79%	0.30

Part C – Non-monetised benefits and costs

Table 15: Non-monetised benefits and costs

Cost/Benefit	Description	Rating
Better Service Quality	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.	Highly beneficial
More Suitable for High Density Areas	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.	Highly beneficial
Increases 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.	Highly beneficial
High 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 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.	Highly beneficial
Increased Speed in Loading and Travel	Rail cars have multiple entrances which allow faster loading than buses which only have one entrance.	Moderately beneficial

Cost/Benefit	Description	Rating
Adaptability of Rail	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.	Moderately beneficial
Emergency Services Can Use Rail Track	Emergency services vehicles can use the tail tracks in an emergency situation to avoid traffic thus increasing their response time.	Moderately beneficial
Visibly Appealing	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.	Slightly beneficial
Readily Identifiable Routes	As rail tracks are visible it is easy for potential users to know exactly where the routes are.	Slightly beneficial

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

Cost and Benefits Time Streams (2008, \$million)																	
Year	LRT System				Highway Savings					Bus System Savings			Environmental Cost Savings			Users	Net Flow
	Track Cost	Depots	Rolling Stock	Operating Costs	Decongestion Costs	Maintenance Costs	Accident Costs	V.O.C. Costs	Time Costs	Fleet Cost	Operating Cost	Passenger Time	Air Pollution	Greenhouse Gas	Noise Pollution	Consumer Surplus	
2009	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
2010	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
2011	\$271.31	\$44.07	\$25.74	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	-\$341.11
2012	\$350.23	\$0.00	\$53.70	\$5.08	\$0.00	-\$0.02	\$2.76	\$9.65	\$23.44	\$4.32	\$6.02	\$1.38	\$0.40	\$0.18	\$0.46	\$1.21	-\$359.21
2013	\$377.36	\$82.30	\$96.97	\$11.63	\$0.00	-\$0.04	\$5.52	\$19.30	\$46.88	\$8.65	\$12.04	\$2.77	\$0.79	\$0.37	\$0.91	\$6.17	-\$464.91
2014	\$308.30	\$0.00	\$27.09	\$18.69	\$0.00	-\$0.06	\$8.28	\$28.95	\$70.32	\$12.97	\$18.06	\$4.15	\$1.19	\$0.55	\$1.37	\$15.50	-\$192.81
2015	\$0.00	\$0.00	\$24.33	\$24.46	\$0.00	-\$0.08	\$11.04	\$38.60	\$93.76	\$17.29	\$24.08	\$5.54	\$1.58	\$0.73	\$1.82	\$29.25	\$174.83
2016	\$0.00	\$22.82	\$4.87	\$27.69	\$0.00	-\$0.10	\$13.80	\$48.25	\$117.20	\$21.61	\$30.10	\$6.92	\$1.98	\$0.91	\$2.28	\$36.57	\$224.14
2017	\$0.00	\$0.00	\$5.34	\$29.37	\$0.00	-\$0.09	\$13.72	\$48.78	\$120.66	\$21.68	\$30.18	\$8.07	\$1.94	\$0.90	\$2.23	\$37.91	\$251.28
2018	\$0.00	\$0.00	\$5.82	\$31.04	\$0.00	-\$0.08	\$13.63	\$49.31	\$124.12	\$21.74	\$30.27	\$9.23	\$1.89	\$0.88	\$2.19	\$39.26	\$255.59
2019	\$0.00	\$0.00	\$6.30	\$32.72	\$0.00	-\$0.07	\$13.55	\$49.84	\$127.58	\$21.81	\$30.36	\$10.38	\$1.85	\$0.86	\$2.15	\$40.61	\$259.90
2020	\$0.00	\$0.00	\$6.78	\$34.40	\$0.00	-\$0.06	\$13.47	\$50.37	\$131.04	\$21.87	\$30.45	\$11.54	\$1.81	\$0.84	\$2.10	\$41.95	\$264.21
2021	\$0.00	\$0.00	\$7.26	\$36.07	\$0.00	-\$0.05	\$13.38	\$50.90	\$134.50	\$21.93	\$30.54	\$12.69	\$1.77	\$0.82	\$2.06	\$43.30	\$268.52
2022	\$0.00	\$0.00	\$7.34	\$37.13	\$0.00	-\$0.06	\$13.38	\$49.96	\$140.74	\$21.83	\$30.40	\$14.34	\$1.73	\$0.81	\$2.03	\$45.48	\$276.17
2023	\$0.00	\$0.00	\$7.42	\$38.19	\$0.00	-\$0.07	\$13.37	\$49.03	\$146.98	\$21.73	\$30.25	\$15.98	\$1.70	\$0.80	\$2.00	\$47.66	\$283.82
2024	\$0.00	\$0.00	\$7.50	\$39.25	\$0.00	-\$0.07	\$13.37	\$48.09	\$153.22	\$21.62	\$30.11	\$17.63	\$1.66	\$0.78	\$1.97	\$49.84	\$291.46
2025	\$0.00	\$0.00	\$7.58	\$40.31	\$0.00	-\$0.08	\$13.36	\$47.15	\$159.46	\$21.52	\$29.96	\$19.27	\$1.62	\$0.77	\$1.94	\$52.03	\$299.11
2026	\$0.00	\$55.77	\$7.66	\$41.37	\$0.00	-\$0.09	\$13.36	\$46.21	\$165.70	\$21.41	\$29.82	\$20.92	\$1.59	\$0.76	\$1.91	\$54.21	\$251.00
2027	\$0.00	\$0.00	\$8.62	\$42.72	\$0.00	-\$0.08	\$13.25	\$48.02	\$170.10	\$20.96	\$29.19	\$23.28	\$1.50	\$0.72	\$1.83	\$56.25	\$313.68
2028	\$0.00	\$0.00	\$9.58	\$44.06	\$0.00	-\$0.08	\$13.14	\$49.82	\$174.50	\$20.51	\$28.57	\$25.65	\$1.41	\$0.69	\$1.74	\$58.29	\$320.60

Appendix F Cost and Benefit Time Streams

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Year	LRT System				Highway Savings					Bus System Savings			Environmental Cost Savings			Users	Net Flow
	Track Cost	Depots	Rolling Stock	Operating Costs	Decongestion Costs	Maintenance Costs	Accident Costs	V.O.C. Costs	Time Costs	Fleet Cost	Operating Cost	Passenger Time	Air Pollution	Greenhouse Gas	Noise Pollution	Consumer Surplus	
2029	\$0.00	\$0.00	\$10.53	\$45.41	\$0.00	-\$0.08	\$13.04	\$51.62	\$178.90	\$20.07	\$27.94	\$28.01	\$1.32	\$0.65	\$1.66	\$60.33	\$327.52
2030	\$0.00	\$0.00	\$11.49	\$46.75	\$0.00	-\$0.07	\$12.93	\$53.42	\$183.30	\$19.62	\$27.32	\$30.38	\$1.24	\$0.62	\$1.57	\$62.37	\$334.44
2031	\$0.00	\$0.00	\$12.45	\$48.10	\$0.00	-\$0.07	\$12.83	\$55.22	\$187.70	\$19.17	\$26.69	\$32.74	\$1.15	\$0.58	\$1.49	\$64.41	\$341.37
2032	\$0.00	\$0.00	\$12.96	\$49.30	\$0.00	-\$0.07	\$12.77	\$57.02	\$192.10	\$18.72	\$26.07	\$35.10	\$1.06	\$0.55	\$1.41	\$66.45	\$348.91
2033	\$0.00	\$0.00	\$13.48	\$50.50	\$0.00	-\$0.07	\$12.72	\$58.82	\$196.50	\$18.27	\$25.44	\$37.47	\$0.97	\$0.51	\$1.32	\$68.49	\$356.46
2034	\$0.00	\$0.00	\$14.00	\$51.70	\$0.00	-\$0.08	\$12.66	\$60.62	\$200.90	\$17.82	\$24.82	\$39.83	\$0.88	\$0.47	\$1.24	\$70.54	\$364.01
2035	\$0.00	\$0.00	\$14.52	\$52.91	\$0.00	-\$0.08	\$12.61	\$62.42	\$205.30	\$17.37	\$24.19	\$42.20	\$0.80	\$0.44	\$1.15	\$72.58	\$371.55
2036	\$0.00	\$0.00	\$15.04	\$54.11	\$0.00	-\$0.08	\$12.55	\$64.23	\$209.70	\$16.92	\$23.57	\$44.56	\$0.71	\$0.40	\$1.07	\$74.62	\$379.10
2037	\$0.00	\$0.00	\$15.56	\$55.31	\$0.00	-\$0.08	\$12.49	\$66.03	\$214.10	\$16.48	\$22.94	\$46.92	\$0.62	\$0.37	\$0.99	\$76.66	\$386.65
2038	\$0.00	\$0.00	\$16.08	\$56.51	\$0.00	-\$0.08	\$12.44	\$67.83	\$218.50	\$16.03	\$22.32	\$49.29	\$0.53	\$0.33	\$0.90	\$78.70	\$394.19
2039	\$0.00	\$0.00	\$16.60	\$57.71	\$0.00	-\$0.09	\$12.38	\$69.63	\$222.90	\$15.58	\$21.69	\$51.65	\$0.45	\$0.30	\$0.82	\$80.74	\$401.74
2040	\$0.00	\$0.00	\$17.12	\$58.92	\$0.00	-\$0.09	\$12.33	\$71.43	\$227.30	\$15.13	\$21.07	\$54.02	\$0.36	\$0.26	\$0.73	\$82.78	\$409.28
2041	\$0.00	\$0.00	\$17.63	\$60.12	\$0.00	-\$0.09	\$12.27	\$73.23	\$231.70	\$14.68	\$20.44	\$56.38	\$0.27	\$0.23	\$0.65	\$84.82	\$416.83

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.

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.

Type of Vehicle	Cost per vehicle kilometre (\$)
Car	0.45
Bus	2.85

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

	Rail (\$ per vehicle km)	Bus (\$ per vehicle km)	Car (\$ per vehicle km)
Air Pollution	0.0396	0.2861	0.0254
Greenhouse Gas	0.0064	0.1179	0.0200
Noise Pollution	0.0204	0.0526	0.2599

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.

Factor	Measurement
Operating Cost per kilometre	\$4.15
Vehicle Cost	\$240,000
Replacement Period	15 years

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.

Type of vehicle	Average Speed (kilometres per hour)
Bus	40.7
Light Rail	43.6

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.

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).

Type of Injury	Cost (\$)
Fatal	\$1,870,585
Injury	\$150,000
Property Damage (only)	\$17,518

Appendix H References

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