



ACT LIGHT RAIL COST ESTIMATES (REVISED MAY 2023)

Summary

Light rail in Canberra has been a hotly debated matter ever since the 2012 ACT election when the Labor Party unnecessarily agreed to the Greens Party demand to build Stage 1 of light rail (Gungahlin-Civic) in return for forming a coalition government in perpetuity, including major ministerial posts held by the leader of the Greens Party.

Stage 2 (Civic-Woden) is the result of an 11th hour promise by the Chief Minister just before the 2016 election, but made without any consultation or consideration of the vast cost.

The estimates in this paper for each stage are for construction, financing and for 20 years of Operations & Maintenance (O&M), in 2023 prices. The most probable, minimum cost of Stage 2 is \$3.1B¹, comprising \$0.58B for Stage 2A and \$2.52B for Stage 2B. The mooted extension from Woden to Mawson would add a further \$0.35B, for a potential cost of \$3.45B for an extended Stage 2.

Readers should note that, in March 2023, the ACT Liberal Party announced that it would formally oppose light rail Stage 2, citing a cost of \$3B for the project (excluding a Mawson extension).

Then added to the expected contract cost, the taxpayer must also pay the substantial costs of Government administration of project development and ongoing contact administration. With the certain knowledge that such major projects virtually always blow-out, who knows what the final costs might be?

Patronage for Stage 1, even at maximum capacity of the 12 operational trams, has been considerably lower than predicted in the Business Case. Projected patronage for Stage 2B can be expected to be even lower, given that the Gungahlin-Civic route was chosen as the most promising of all contemplated routes.

The truly sad part of the financial mess that is light rail in Canberra is that it could and should have been done with a Bus Rapid Transit (BRT) system at half the cost. Urban transformation – the much-touted justification by the Government for light rail – does not require light rail; it needs only an effective and efficient rapid transport corridor that a modern BRT system would provide. How non-sensical is it for the ideologically-driven Greens/Labor Government to insist on light rail to Woden that would take twice the travel time than buses for such an unnecessary cost?

Purpose

This document provides and discusses the latest independent cost estimates by Smart Canberra Transport and Australian Logistics Study Centre (ALSC) for ACT light rail Stage 1, Stages 2A, 2B and the possible Stage 2 extension from Woden Town Centre to Mawson, based on relevant information released by the ACT Government, reports in the media and on independent life-cycle cost analysis. However, it should be noted by readers that the ACT Government is parsimonious at best in release of any cost information and contract details in respect of light rail.

Review of Stage 1

Stage 1(Gungahlin-Civic) followed the Parliamentary Agreement between the Greens and Labor after the 2012 election that construction of Stage 1 would start before the 2016 election, which it did. It has been operating since April 2019, quite successfully, given the effects of the unpredicted COVID-19 pandemic which cut patronage considerably.

At Annex A, Table A2A gives basic financial and other facts about Stage1, upon which much of the estimates for Stage 2 are largely based. Figures therein are from published project and Auditor-General documentation.

Table A2B gives details of achievement in respect of patronage and revenue. At its best to date, Stage 1 has managed about 4.6M² boardings in a year (pre-COVID), with maximum boardings in the morning and evening rush hours. The Canberra Times reported (16May23) that Stage 1 clocked-up 892,501 ‘user trips’ in the December quarter of 2022 and extolled that as a great achievement. Yet, if extrapolated over the year, that would be 3.57 million for the year. Both figures, being at capacity now at peak hours, are a long way

¹ B=billion

² M= million



from the Stage 1 Business Case,³ being 4.76 million in 2021 and 6.36 million by 2031. These latter figures were used as a major justification of Stage 1.

The current ACT Greens Party website stretches the truth somewhat in claiming that “*Light rail stage 1 is already a great success. Passenger numbers have already surpassed the business case patronage estimates two years ahead of schedule!*” This is plain misinformation, as the figures in Table A2B show.

The Greens also have a bad habit of claiming that light rail runs on 100% renewable energy, when the Party leader is on record as admitting that the ACT may be buying 100% renewable energy but is consuming energy about 63% fossil-fuelled.⁴

In the early days of Stage 1, Mr Flint (Principal of ALSC) had discussions with Capital Metro about what he considered to be improper practice by Capital Metro to discount nominal figures to a Present Value (PV) in 2016 by the claimed 7.52% pa rate, which deliberately underestimated the published cost, instead of by the assumed average inflation rate over the contract period (here assumed to have been 3% pa). Capital Metro maintained its position.

However, it can be seen from Table A2A that that Capital Metro (and the Government) were in fact in error, as indicated by its result for the value of Operations & Maintenance (O&M) being only 36% of the build cost. This is far too small a figure for a capital project such as this. As shown in Table A2A, the correct percentage is about 96% of build cost, which is consistent with life-cycle ratios for most major capital projects. This figure has been used in Table A5 to estimate O&M costs for both Stage 1 and Stage 2.

At the time, in 2016, the Government was claiming that the Present Value (PV) cost for Stage 1 was \$939M, being the nominal value of \$1.780B (expenditure 2019-2039) discounted to January 2016, whereas in fact it was around \$1.31B. In 2023 prices, the PPP⁵ Contract price has escalated to around \$1.751B, with a total project cost of about \$1.93B to ACT taxpayers.

One should note that, although the Business Case for Stage 1 tried to justify a Benefit to Cost Ratio (BER) of 1.2, the Auditor-General’s report on Stage 1 said the BER was only 0.49, in realisable terms, after ignoring the list of claimed additional wider social benefits used by the Government to get to arrive at the BER of 1.2.

The ACT Government has since moved away from justifying light rail on social benefit terms to one based on corridor in-fill development, ie ‘urban transformation’. That is fair enough but light rail is not in fact required to meet such an aim. Effective urban transformation requires only an effective, transport corridor, which could be met by an Electric Bus Rapid Transit (EBRT) system using modern electric buses or even trackless trams, at a fraction of the cost of light rail.

The ACT Government has not yet published any statement on the extent of claw-back of Stage 1 costs through sales of property or taxes on development properties, probably because it would not justify the cost and disruption of light rail. The \$600 million plus received from selling public accommodation along Northbourne Ave, which was supposed to be used to rehouse the ejected tenants, is reported to have found its way to paying for the tram. See Box 1.

Box 1 – Public housing money lost to funding light rail

While the Housing Minister might not be able to say where the ACT government’s promised hundreds of millions for public housing disappeared to, Jon Stanhope and Khalid Ahmed can. It was pumped into light rail. Here’s what happened...

We wrote last week about a disagreement between Opposition Leader Elizabeth Lee and Housing Minister Yvette Berry about the Public Housing Renewal Program (PHRP).

At its heart were Lee’s claims the ACT government had, in three successive Budgets from 2015-16, stated that it was investing around \$700 million in public housing but that it had not done so.

City News, 22 August 2022

³ Complete Business Case Stage 1 Light Rail, Capital Metro, ACT Government, [undated but probably 2016]

⁴ It was reported on ABC News Radio, June 17, that Mr Rattenbury admitted what numerous correspondents have pointed out in letters for several years, that while the ACT pays for the equivalent of 100 per cent of its electricity, on a day-to-day basis it does not consume 100% renewable electricity, in being connected into the NSW grid. In fact, the ACT consumption of electricity is about 63% fossil-fuelled.

⁵ PPP = Private Public Partnership



Stage 1 may well be appreciated by the 3 to 4 per cent of Canberrans able to take advantage of it, but not by the remainder of Canberrans having to pay for it.

As a reminder, because of a Greens demand agreed to by Labor after the 2012 election, ACT taxpayers are stuck with paying for a tram instead of a BRT system, which, in its own government reports, said was twice as cost-effective as light rail.

Stage 2

For Stage 2 (Civic-Woden), the ACT Government:

- has opted for a west London Cct/Commonwealth Avenue, east State Circle, Adelaide Avenue (along centre nature strip), Yarra Glen route (along centre nature strip) to Woden Town Centre;
- broken Stage 2 into Stage 2A (Civic-Regatta Point) and Stage 2B (Regatta Point-Woden Town Centre);
- mooted the possible extension of Stage 2B to Mawson;
- for Stage 2A, decided that London Cct would be raised to the level of Commonwealth Avenue, with traffic lights at the intersection, and that there would be a bridge over Parkes Way; and
- is in ongoing negotiations with the National Capital Authority (NCA) in respect of possible changes to Commonwealth Ave bridge and transit through the Parliamentary Triangle. However, NCA has recently announced an independent upgrading of the bridge and left it to the ACT Government to address how the lake may be crossed for light rail and to pay for it.

See Table A3 for details of proposed routes and particular infrastructure difficulties that boost the cost per Km. In particular, it should be noted that much of the proposed route along Yarra Glen is a water course and will require substantial earthworks to create a suitable base for the proposed track. Several of the bridges along the route would have to be modified to accommodate the tram, by an additional span, in the case of crossing Hopetoun Cct, and relocation of supporting columns under several other bridges, eg at Carruthers St. Then there are a number of intersections and associated traffic lights that would have to be installed or modified and at least two footbridges/elevators needed for access to trams along Adelaide Ave.

Stage 2A

Once the sheer difficulty and probable cost of Stage 2 dawned upon the Government after the 2016 election, the Government split Stage 2 into two sub-stages, with Stage 2A limited to a feasible but expensive leg from Civic to Regatta Point.

Although only 1.7Km⁶, it is very expensive in incurring the decision to raise London Cct and install a complicated intersection at an estimated cost of some \$100M. In addition, there would be a bridge needed across Parkes Way and upgrading of the Acton waterfront.

In respect of raising London Cct, one needs to recognise that it was not really needed for light rail but, rather, was a political decision to capture the valuable land now taken up by the clover-leaf access to Commonwealth Ave.

In respect of the Acton waterfront, contrary to what the Auditor-General⁷ says, the Government had neglected to include this cost against Stage 2A. A Figure of \$50M is attributed here to the Acton waterfront.⁸ⁱ

Given a miserable BER⁹, of 0.38, according to a thoroughly inadequate business case, poor expected patronage of about 1 million pa and some \$583M, over 20 years for 1.7Km, Stage 2A by itself is a very poor investment. It only makes sense if Stage 2B eventually proceeds, which, given the major infrastructure

⁶ Km = kilometre

⁷ ACT Auditor-General's Report Canberra Light Rail Stage 2A: Economic Analysis Report No. 8 / 2021, 24Sep21

⁸ Auditor-General report says \$23M in 2019, discounted at %7pa. Therefore, \$30M in 2023 But this figure is highly suspect, so use \$50M

⁹ The Benefit Cost Ratio for Light Rail Stage 2a, calculated to two decimal places, was 0.38 excluding Wider Economic Benefits and 0.56 including Wider Economic Benefits.



difficulties to overcome, may not happen at all using light rail. That is not to say that an EBRT system would not be used instead to connect Regatta Point to Woden, which is the obvious, rational way to go. Whatever the future, Stage 2A is a very expensive waste of taxpayers' money.

Stage 2B

Compared to the simpler Stage 1 route, the route to Woden poses many challenges at considerable expense. There are many infrastructure difficulties to be overcome: a bridge over the lake; getting through the Parliamentary Triangle; the need for a new centre span to the overpass at Hopetoun Cct; the need for footbridge/elevator access along Adelaide Ave; the need to modify/move the support columns for several bridges across the route; significant and major earthworks along the route for adequate width¹⁰ and a suitable (flood-free) track; extensive earthworks required to cross the flood-prone Yarra Glen/Yamba Dve roundabout (0.75Km) ; and the need to modify several intersections to get to the terminal at Callum St.

Because of restrictions specified by the NCA for light rail to transit the Parliamentary Triangle, there will be no overhead power supply wire permitted and, consequently, trams to Woden will have to be provided with adequate batteries for power, at additional capital and O&M expense.

See Table A3 for details of probable infrastructure challenges along the route for Stage 2B.

From Table A5, in 2023 prices, the construction cost for Stage 2B is about \$1.361B (excluding financing costs) for 10.1 Km and a 20-year PPP contract value of \$2.516B.

The complicated nature of Stage 2B results in an expected build cost of some \$135M per Km compared to \$63M (actual) per Km for Stage 1 (2023 prices) (excluding financing costs).

With patronage expected at only about 3.5 million pa, the economics of Stage 2B do not make much sense. The Government should drop light rail for Stage 2B in favour of an EBRT solution, which, among other savings would obviate the need for an expensive, dedicated bridge across the lake and would achieve the same objectives for urban in-fill along the corridor.

Stage 2B Extension

The possible extension from Woden to Mawson, along Callum St and along Athllon Dve is relatively straight forward as far as infrastructure is concerned, except for several intersections to cross, especially the major one at Hindmarsh Dve. Its cost for a light rail solution would be a 20-year cost of \$350M for 2 Km.

Estimates

Cost estimates for Stages 1, 2A, 2B and 2B Extension and for the expected overall network, are summarised in Tables 1-3, with detailed estimates given in Tables A2 (build only) and A5 (complete estimates) at Annex A.

Project Costs [Table A5]

Estimates for project costs of the main PPP contracts are summarised in Table 1. These comprise the cost of construction, normally over three to six years, and 20 years of operations and Maintenance (O&M). Earlier estimates have been updated to 2023 prices.

The expected¹¹ cost of Stage 1 is **\$1.75B** and Stage 2A and 2B at **\$3.1B**, for a total of **\$4.85B** to be committed to these two stages alone (2023 prices). Yet, given some risk, these figures could easily be significantly higher. An extension to Mawson would add another **\$0.35B**

Readers should note that, in March 2023, the ACT Liberal Party announced that it would formally oppose light rail Stage 2, citing a cost of \$3B (excluding a Mawson extension).

Although very early days, the planned light rail network overall could cost around **\$14.7B**.

Relatively speaking, Stage 2 will be the most expensive of all stages envisaged because of the decision to raise London Cct, at a nominal cost of some \$100M and the need to cross the lake by modification of Commonwealth Ave bridge, at a nominal cost of \$300M. These nominal costs have been derived from the following:

¹⁰ The centre nature strip is not necessarily wide enough in places to accommodate two tracks.

¹¹ 'Expected' figures are point estimates and not probably minimums.



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- In its submission,¹² in 2018, to the Joint Standing Committee on the NC&ET, in respect of Stage 2 options, the ACT Government gave the estimates of \$1.3B to \$1.6B for construction only for Stage 2 (Commonwealth Ave option) and Stage 2 (Kings Ave option).
- In a recent published article,¹³ it was reported that Chief Minister Barr baulked at the figure of \$140 million for works on Parkes Way that would be needed to accommodate a stadium on the current swimming pool site.

However, raising London Circuit for Stage 2A of light rail is a far more complicated project which, on the basis of the Parkes Way estimate, could cost about \$100M, if not more.

It has been assumed, for the purposes of this analysis, that raising London Cct and modification of the Commonwealth Ave bridge together would cost \$400M which applies only to a light rail solution and would be largely avoided if the Government were to opt for an EBRT system instead, at a fraction of the cost. Statements by letter writers such as “...light rail will continue to enable far more cost-effective transit-oriented development ...”, is nonsense. Planned development along a route does not depend on trams - rapid bus transit would do just as well at a fraction of the cost.

TABLE 1 Light Rail Summary cost Estimates		Present Values [0] [1] [2]				[notes] Comment
		2016	2023			
Stage	Length Km	PPP (20 Y) Contract \$B	PPP (20 Y) Contract \$B	Project Office \$B	Real Cost Taxpayer \$B	
		[3] [4]	[5]	[6]	[7]	
Stage 1: Gungahlin-Civic	12	1.42	1.75	0.10	1.93	Includes \$Interest paid by ACT on Capital Contribution of \$375M
Stage 2+2B Extension	12.1		3.45	0.15	3.60	
Stage 2: City-Woden	11.8		3.10	0.15	3.25	
Stage 2A: City-Regatta Point	1.7		0.58	0.05	0.63	
Stage 2B: Regatta Point-Woden	10.1		2.52	0.10	2.62	
Stage 2B Extension: Woden-Mawson	2		0.35	-	0.35	
Network	75.8		14.68	0.75	15.51	Rough estimate only
Notes:						
0. All costs shown are expected (average) Present Value(PV) estimates; risks could mean higher costs.						
1. Nominal total project costs (20 years repayment) depends on discount factor assumed; eg.						
A. Nominal project cost for Stage 1 was \$1.79B (Auditor-General figure, 2016)						
B. The government used an erroneous discount factor of 7.52%pa, deliberately giving a low PV of \$0.939B						
C. Using a realistic discount rate of 3%pa, gave the PV at \$1.31B						
2. 2023 Build costs extrapolated to 2023 from known Stage 1 build costs (2016)						
3. Stage 1 under PPP contract since 2016						
4. Stage 2A partially under contract. Other stages in the future.						
5. PPP Contract for 20 years of O&M. Paid over 20 years from commissioning.						
Excludes \$Interest incurred by ACT on Capital Contribution of \$375M.						
6. Project Office cost provides for project office staffing and non-PPP contracts, eg for consultants.						
7. An initial Capital contribution applies only to Stage 1.						

Budget implications [Table 2]

The budget implications of Stage 1 are bad enough at an expected **\$76M** per annum (2023 prices). However, note that:

- a lump-sum Capital Contribution was paid upon commissioning in 2019, which would otherwise have been amortised over the O&M period, and that.
- the ACT Government received some \$65M from the Federal government as a result of selling off government assets like the ACTTAB.

Stage 2A and 2B will add another (expected) **\$208M** per annum to budget expenditure, once completed (\$38 for Stage 2A and \$168M for Stage 2B)

¹² S5.8 of ACT Government submission to the Joint Standing Committee on the National Capital and External Territories, on light rail Stage 2 options, May 2018.

¹³ The \$200m Parkes Way and Civic Pool work that led Andrew Barr to ditch the Civic stadium project, Canberra Times, 1 September 2022.



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Together Stages 1, 2A and 2B will cause an expected budget expenditure of about \$284M per annum. Can this huge impost be logically sustained given the ACT's rapidly increasing government debt? The implication of course is that it will mostly be paid for with additional debt.

While the Government expects to 'claw back' expenditure from development and ongoing property taxes, it has not yet made public estimates of 'claw back' from Stage 1 let alone what it may expect from Stage 2.

Admittedly, Canberra needs a rapid transit system but light rail is not the best solution. An EBRT system at about half the cost would serve the travelling public just as well and faster.

In respect of funding for Stage 2, the new Federal Labor government has promised \$185M and possibly in addition to the \$135M that had been promised by the preceding government. But it yet remains to be seen how much in total will eventuate. In addition, given modification of Commonwealth Ave bridge, it will be interesting how much of the huge cost will be met by the Federal Government, if any. These estimates assume the ACT Government will pay, given that any modification would be only to accommodate the tram. A similar argument would apply to any costs incurred in the Parliamentary Triangle – who would pay?

TABLE 2			Nominal	Nom/PV at	%Discpa
Light Rail Summary- Budget payments pa		2023	2023-43	1.344	3%
Stage	Length Km	PPP (20 Y) PV \$B	PPP (20 Y) Nominal \$B	PPP (20 Y) \$Repay \$M pa	Notes
Stage 1: Gungahlin-City	12	1.75	1.89	75.7	[1] [2]
Stage 2+2B Extension	12.1	3.45	4.64	232	
Stage 2: City-Woden	11.8	3.10	4.16	208	
Stage 2A: City-Regatta Point	1.7	0.58	0.78	39	[3]
Stage2B: Regatta Point-Woden	10.1	2.52	3.38	169	[3]
Stage2B Extension: Woden-Mawson	2	0.35	0.47	24	[3]
Network	75.8	14.68	19.73	986	[4]
Notes:					
1. Stage 1 repayment (ave) \$1.89B nominal (excludes \$0.375B cap contribution)/20 years					
2. Stage 1 contract at \$1.78B nom in 2016, but such contracts provide for escalation of costs.					
3. 2023 PVs x Nom/PV ratio of 1.344 to get Nominal values over 20 years					
3. Nom/PV ratio of 1.344 at 3% discount rate over 20 years					

Costs per boarding [Table 3]

If readers may have thought that project cost were outrageous, give a thought to the probable government subsidy of passengers.

As may be seen from Table 3, the expected subsidy of every boarding on Stage 1 is about \$15 (less the average per boarding of actual fares paid).¹⁴

For Stage 2A, the expected subsidy increases to \$39 per boarding.

For Stage 2, once all completed, would incur an expected subsidy of \$59 per boarding.

One can only imagine how rates and taxes will be hiked to pay for this folly.

¹⁴ An adult fare is currently \$3.22.



TABLE 3						
Light Rail Summary-Costs per Boarding						
Stage	Length Km	Patronage per leg		Cost per Boarding		Notes
		Min M pa	Max M pa	Max \$	Min \$	
			[1]			
Stage 1: Gungahlin-City	12	4.6	6.4	16	12	[2] [3]
Stage 2+2B Extension	12.1	3.5	4.9	66	48	[4]
Stage 2: City-Woden	11.8	3.5	4.9	59	43	[4]
Stage 2A: City-Regatta Point	1.7	1.0	1.4	39	28	[5]
Stage 2B: Regatta Point-Woden	10.1	3.5	4.9	48	35	[4]
Stage 2B Extension: Woden-Mawson	2	3.5	4.9	7	5	[4]
Network	75.8	3.0	4.2			
Notes:						
0. Subsidies = Cost per boarding less average fares paid.						
1. Max/Min ratio assumed = 6.4 (Business Case)/4.6 (actual best to date)= 1.39,						
2. Stage 1 patronage is 6.4 M in 2016 Business Case						
3. Best Stage 1 patronage to date (full trams) has been 4.6 M pa						
4. Stage 2B and 2B extension patronage assumed 75% of Stage 1 achievements.						
4. The City-Woden line is assumed never to reach same level of patronage as Stage 1						
5. Stage 2A very low until Stage 2B comes on stream						

Justification?

Stage 1

In the early days of Stage 1, the Government tried to justify the project on the basis of a Benefit to Cost Ratio (BCR) of 1.2, established in the questionable Business case, by invoking numerous so-called ‘wider benefits’ to which were attributed unjustifiable dollar values. Independent analysts put the BCR at about 0.6 and the Auditor-General in its report at only 0.49¹⁵. The Government eventually realised that the project was uneconomic in the real sense, so then tried to justify it as an essential catalyst to ‘urban transformation’.

Note that the Government has never provided any estimates on the economic benefits of this ‘urban transformation’, e.g., clawback on the sale of real estate and ongoing rates. Critics of the project have always maintained that an EBRT system over the same corridor would bring the same or better ‘urban transformation’ at a fraction of the cost of light rail. Moreover, it is problematic whether it is a tramline or, simply, good planned population growth that really promotes ‘urban transformation’.

Stage 2

Stage 2 of light rail (Civic-Woden) was an 11th hour election promise by the Labor Party, just before the 2016 election, that was neither costed nor discussed with any Federal authority before the announcement.

In mid-2018, the Joint Standing Committee for the National Capital and External Territories (JSCNCET) inquired into the planned Stage 2. In its submission to the Committee, the ACT Government offered a cost estimate for the construction alone of Stage 2 over Commonwealth Avenue bridge of from \$1.3B to \$1.6B, about twice that for Stage 1, for a similar distance (12.1 kilometres).

After years of trying to convince Canberrans that Stage 1 would have anywhere near a positive Benefit to Cost Ratio, the Government no longer pretends that light rail is an economic proposition but, rather, says for Stage 2 that it “... would look beyond simple benefit cost ratio modelling in making its investment decision and will take into account matters such as its overall vision for Canberra, community sentiment, urban benefits and other factors.”¹⁶ In other words, this Government appears to pay scant attention to the opportunity costs foregone with light rail. Is ideology trumping rationality and good city administration?

In its submission last June to the JSCNCET, the ACT Government epitomised its case through oft-stated claims of the benefits of light rail, in particular that “Light rail will have a transformational effect in

¹⁵ ACT Auditor-General's report: initiation of the light rail project, Report No. 5 / 2016, Page 1, Overall Conclusion.

¹⁶ Canberra Times, 20 June 2018, “Cost of Canberra’s light rail stage 2 revealed”.



Canberra ... and providing efficient, environmentally responsible public transport.”¹⁷ Close scrutiny of these claims show that they are primarily ideological, of very doubtful validity and offer maximum benefits to developers and fellow travellers but with minimal benefits to Canberran taxpayers who have to foot the bill.

The Government has produced a business case for Stage 2A but not yet one for Stage 2B, at least not one published.

The business case for Stage 2A is a pitifully inadequate document and for which the published version was heavily redacted of all cost information and of contractual information of any value. The Auditor-General, in its report¹⁸ 8/2021, heavily criticised the document and recommended that it be redrafted. However, as with the case of the Auditor-General’s report in 2016 on Stage 1 Business Case, the Government has effectively ignored these reports.

Ill effects of light rail

The opportunity costs of light rail in Canberra are simply too great to be sustained.

Until the current Government reveals the true costs of light rail, which it will probably never do, readers should take note of the figures in this report and think hard about the deleterious effects that the sheer waste on light rail is having already on our hospital/health system in particular, as well as on general maintenance of city and suburban infrastructure.

If readers are in any doubt about the ill effects of diversion of funds to light rail, they should read, among many reports in the media, the article about “health system failures’ in the Canberra City News of 21Sep22, especially taking note of Chart 1 which shows that the sharp shortfall in hospital beds coincided with the start of construction of Stage 1 light rail (2015-16) which, after start of operations, cost taxpayers an initial slug of \$375M plus some \$64M per annum thereafter for 20 years – just for Stage 1. With the committal of this ideological government to Stages 2A and 2B, Canberran taxpayers can expect a much greater slug to the annual budget, at the expense of more important and needed infrastructure.

For the whole network, as currently envisaged and with timeframes for construction extending as much as 40 to 50 years for completion, at about \$14.7B (2023 prices) but \$19B in nominal terms, the cost to the budget and taxpayers would grow with each added stage to some \$986M per annum, before gradually reducing.

The current ACT 2022-23 budget¹⁹ provides for a total expenditure of \$7.78B (\$0.483B deficit), of which over \$488M is for transport (mostly Action buses and light rail Stage 1) plus project expenditure of \$87M for light rail Stage 2 (\$124M over four years). With such figures, the Government has in the past and could be expected to continue claiming that light rail is affordable.

However, very uneconomic projects like light rail are always a waste of taxpayers’ funds, no matter how affordable the Government may claim them to be.

Conclusion

From the foregoing, it can be seen that Stage 1 is not economic and that Stage 2 is extremely uneconomic. This is especially so considering that the planned ‘urban transformation’ effect for Stage 2 would almost certainly be less than for Stage 1²⁰ and that the same ‘urban transformation’ could be achieved by use of technological solutions available today and the near future for EBRT systems, at a fraction of the cost of light rail.

One may ask what is the value of this analysis and report, if it were to be completely ignored and simply dismissed by the government, as like those of even the Auditor-General? Notwithstanding ignorance by the Government, this report has been prepared for the public record (published on www.alogstudycentre.com.au/light_rail) so that readers may have at least one account of what the

¹⁷ Gungahlin To Woden (via Barton) Light Rail Submission to the Joint Standing Committee on the National Capital and External Territories; ACT Government – Transport Canberra and City Services, 15 June 2018

¹⁸ Canberra Light Rail Stage 2A: Economic Analysis Report 8/2021, September 2021

¹⁹ 2022-23-Budget-Outlook

²⁰ Note that the Gungahlin-Civic route was selected as the first stage of light rail because it offered greatest potential for ‘urban transformation’, so, by definition, all other routes would be inferior by definition, for this measure..



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Government is not telling them and for them to demand answers as to the true situation on light rail costs and benefits.

Max Flint²¹

Co-ordinator, Smart Canberra Transport (SCT)²²

21 May 2023

²¹ Max Flint is a retired senior officer of the RAAF, who is a qualified engineer and has a Master of Science Degree (Logistics Management with distinction). He was an acquisition manager of major capital projects in Department of Defence and for 16 years was a private consultant, specializing in support systems and life cycle costing for major capital projects.

²² Smart Canberra Transport maintains the light rail section of website www.alogstudycentre.com.au



LIGHT RAIL COST ESTIMATES

Estimates - structure

Dollar values cited are either in 2016 or 2023 prices.

For each stage of light rail there are four primary cost estimates:

- for the Private, Public Partnership (PPP) contract - construction plus 20 years of Operations and Maintenance (O&M);
- implications for the ACT Budget;
- subsidies made for each boarding of light rail; and
- Government tram-related project administration costs.

Contract estimates comprise the following components:

- The cost of construction, normally over three or four years. The contract would provide for escalation of costs throughout the construction period. Although (for Stage 1) the Government has said²³ that the contractor would lose Availability Payments for delays in delivery and whether the contract provides or not for ‘unexpected’ ‘blow-out’ costs, large contractors normally find a way through contract provisions or outright claim, to recover all costs and profits from a government.
- The cost of capital (equity and debt) committed during construction: This component is extremely important because it is not included in the basic construction cost but recoverable through the agreed annual Availability Payments²⁴. The Government often implies and most of the public believe that the basic construction project cost is the same as the total cost, but reality is far from that. Note that capital consumed during construction may be a combination of both debt and equity funding. Given contract confidentiality, which the government often cites, it is very difficult for outsiders to establish the actual cost of capital debt incurred by and being recovered by the contractor.
- The O&M costs for each year of the nominal 20 years: These comprise many sub-components, but mainly the costs of staff (administrative, tram operations, engineering, maintenance) and logistics support (facilities maintenance, warehousing and re-equipment).
- Any Capital Contribution made by the ACT Government, i.e. a lump-sum payment on commissioning of a stage: The Capital Contribution for Stage 1 was \$375M (paid in 2019), but there has been no corresponding sum yet mooted or expected for Stage 2. Interest expected to be paid on the \$375M capital contribution, as government debt, has been included in total costs, but not included in repayments made to the PPP Contractor.

Stage 1 was contracted under a PPP arrangement. Under this model the PPP contractor bears all costs up to commissioning of the system, upon which the Government pays the Capital Contribution (if any). The balance of the construction cost plus all costs of capital borrowing and equity are recovered over the O&M period of 20 years, along with the O&M costs themselves, through periodic Availability Payments. Stages 2A and 2B are also expected to be PPP contracts

A Note on estimating

See Box A1

Box A1 – Project Cost Estimating

Life cycle costing for major capital projects may be done with a combination of methods, depending on who is doing it and under what circumstances. The essential methods are often referred to as the parametric method and the quantitative method. Tenderers and contractors will have intimate knowledge of all cost components of a project and, consequently, will use detailed quantitative cost analysis of most if not all components of labour, materials, equipment and infrastructure required, as well as consideration of company policy for return on investment.

²³ Canberra Times, 27Oct18, “Final track laid at city end as builder to miss payments.”

²⁴ Referred to as Service Payments in the ACT budget FY2018-19).



However, independent evaluators, such as in this case by ALSC (or even buyer project officers), where detailed engineering, costing detail and contractual detail is not known (including lack of divulgence by governments), one needs to resort to parametric costing. In such a case, the analyst is forced to base costs on what might be known about similar, completed projects and to extrapolate to the project under analysis. In this case of estimating for Stage 2 of light rail, ALSC has had to use the relatively known costs of Stage 1 of light rail to estimate for Stage 2. A similar approach needed to be taken in respect of the probable costs of the bridges and other infrastructure required for Stage 2, as time permitted but, otherwise, educated guesses may have to do.

Given the uncertainties in parametric estimating, there could be a significant error band involved, that could be resolved by detailed cost risk analysis. ALSC has in fact developed such a cost risk analysis computer model but time has precluded its use. It has been left to readers to apply their own risk margins to the expected values (point estimates) given herein.

Non-PPP Contract, project-related costs

In addition to the PPP contracts, there is a very significant cost of government administration associated with each stage of a project, incurred by the project office and by consultancies and other contracts let outside the PPP contract. In the case of Stage 1, the cost of administration over five years from 2013 through 2018, was in the order of \$150M (verifiable by reference to consecutive ACT budgets). For Stage 2, over a similar period, one could expect the administration cost to be in the order of \$100M but maybe more. Adding this component gives the real cost of the project to the taxpayer. This cost is assumed to be \$100M per annum, as shown in Table A5, in addition to the PPP-contract costs.

In respect of Stage 1, the question has often been asked why the Government choose not to pay up front all of the construction cost when it is able to borrow money considerably cheaper than can a contractor. It has been calculated that, because of that decision, ACT taxpayers would incur an estimated, unnecessary extra \$68M in interest charges (2018 prices). The situation is much worse for Stage 2 given the Government intends to pursue a PPP contract there also and make no capital contribution.

Except for net revenues expected from fares, estimates in this analysis do not include any clawback of costs through land sales, rates or other taxes that the Government may derive from development along a corridor. Such is beyond the scope of this analysis and, in fact, impossible to determine without free access to relevant information and data known only to the Government and perhaps its contractors. However, it should be noted that the Government has not yet published any projected revenues from its claimed 'urban transformation', let alone that attributable directly to the tramline. One could logically ask why not, if it were so much in the Government's interest.

Assumptions

Given the foregoing structure, the main assumptions made for cost estimates by ALSC²⁵ for this paper are shown in Table A1. By their nature, there are always myriad assumptions underlying such estimations, many of which would not affect the end result and so can be safely ignored.

Values applied herein are expected values only. Sensitivity analysis has not been done to establish max/mins for risk on cost components or total costs.

Capital projects have a bad habit of blowing-out in costs, rarely if ever costing less than initial sums estimated or budgeted, due to a number of unknowns (like inflation; wages and materials escalations; interest rates) and by deliberate actions by proponents, especially Governments in trying to hide the true costs. In the latter case, governments will often claim contractual confidentiality to hide the real costs and factors from taxpayers. Light rail is a good case in point.

Discounting of nominal costs of a project, extending over a number of years (23 in the case of Stage 1), is a very controversial methodology and wide-open to abuse, especially by governments attempting to hide the real cost. In the case of Stage 1, the government used a discount rate of 7.52% pa (with no explanation of why that value in any public project documentation). It reduced the Project nominal cost of \$1,780 M to a Present Value in January 2016 (PV 2016) of \$939M. On the other hand, this ALSC model uses a discount rate of 3% pa, being the long-term goal of the Reserve Bank for national inflation (Consumer Price Index (CPI)), which gives a PV 2016 of \$1,309M (Table A2A). The note in Box A2 explains why.

²⁵ Australian Logistics Study Centre (ALSC)



Box A2 – Discounting to Present Values (PV) at a base date

Over the course of a project, component cost incurred will increase each year in line with escalations in wages and costs of materials and services, which are factors in the prevailing CPI, as determined regularly by the Reserve Bank. The interest cost on loans taken out by the contractor is normally the expected CPI plus the lending bank's margin for such loans. The expected return on equity invested in a project by the contractor is set by the contractor as a margin on the expected CPI.

In this ALSC model, the rates of bank interest and return on equity are assumed the same, an assumption that all construction costs are funded by bank loans. This is not strictly true but, in the case of Stage 1, the actual interest rates and return on equity are not known due to contract confidentiality.

During the O&M phase (20 years), the cost of construction (including interest), along with the O&M costs, are recovered by periodic payments, usually monthly. O&M costs will also escalate due to the CPI and profit margin on costs expected by the contractor.

If the CPI over the contract period is assumed to be zero, any margins applied by the contractor will remain as real costs to be recovered, ie the total nominal cost of the project would be the same as the sum of repayments at the start of repayments, ie equal to the Present Value (PV) of all repayments at the Base Date.

Now, if the average escalation in costs over the contract period is greater than zero, discounting needs to be done at the CPI rate (here assumed to be 3% pa) and not at the rate that includes margins on top of the CPI (7.52% assumed by the government). If a rate larger than the assumed %CPI is used, the result would be a sum less than the actual contract value, which would be in error.

Hence the use of the expected average CPI for the repayment period is used as the discount rate.

Modelling assumptions should always be stated (even if open to criticism) and should be subjected to sensitivity analysis due to risk on each cost component, although that has not been done here. Readers may apply their own perspective on risk and effect from the expected values estimated herein, with the knowledge that major projects almost always blow-out in cost.

Should a reader be able to provide what may be considered as more realistic assumptions or assumed values, ALSC would agree to re-run its estimating model.



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Table A1

Main Assumptions of this Paper

SN	Assumptions [1]	Unit	Value	Notes
1	All dollar figures in either 2016 or 2023 prices as shown			
2	Build costs incurred by PPP contractor met by loans or equity			
3	%Interest rate is the same for loans and equity by PPP contractor			
4	No \$Capital contribution by ACT Government for Stages 2A or 2B			
5	\$Interest on \$Capital Contribution met by ACT but not in PPP repayments			
6	%Interest rate (real) on \$Capital Contribution met by ACT	%	2	
7	%Interest rate (real) on loans/equity by PPP contractor	%	3	
8	%CPI	%	3	[2]
9	%Wage Index	%	3.75	[3]
10	%Esc = %Construction Cost Index	%	2.77	[3]
11	%Discount rate - to PV(2016)-applied by ALSC in this paper	%	3	[4]
12	%Discount rate - to PV(2016)-as said by Government	%	7.52	[5]
13	O&M Life of system	Years	20	[6]
14	\$Repayments period to PPP contractor	Years	20	[6]
15	\$Repayments made end of each year			[7]
16	Ratio \$O&M/\$Build (Track, trams and operations) [20 years]	%	96	[8]
17	Ratio \$O&M/\$Build (other infrastructure) [20 years]	%	5	[9]
18	Stage 2B patronage assumed 75% of Stage 1 achievements.			[10]
19	\$Cost-Earthworks (significant)	\$/Km	4.50	[11]
20	\$Cost-Earthworks (major)	\$/Km	6.50	[11]
21	\$Cost-Earthworks(extensive)	\$/Km	8.00	[11]

Notes:

1	Sensitivity analysis not done to establish max/mins for risk on cost components. Risk assessment left to readers.			
2	%CPI set at Reserve Bank long-term goal rate			
3	Light Rail Stage 1 Contract Summary, Capital Metro, June 2016			
4	Same as %Inflation			
5	ACT Auditor-General's Report Initiation of The Light Rail Project Report No. 5 / 2016, 16 June 2016			
6	Business case A-G Report on Stage 1, 2017			
7	Contractually at end of each month, so \$interest would be a bit less.			
8	Derived from Stage 1 project figures			
9	Assumed for infrastructure items (excluding maintenance of the track and power source)			
11	Road Construction Cost and Infrastructure Procurement: 2017 Update; Bureau of Infrastructure, Transport and Regional Economics (BITRE)			

Stage 1 Costs

Table A2A shows the derivation of costs for Stage 1, based on known 2016 PPP contract costs and respective discounting by Capital Metro and by this ALSC modelling. It has been included here because, for Stages 2A, 2B and 2B extension, estimates for the track/tram and O&M components are based on known costs from Stage 1. Estimates for other cost components such as other infrastructure are done independently of Stage 1 costs.



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TABLE A2A Light Rail Summary- Stage 1	%Discount Rates applied			Years 2019-2016
	ALSC %Inflat	Derived %IntReal	A-G Report %IntReal	
2016 Prices	3.00%	5.90%	7.52%	3.00
	[1]	[3]	[2]	[4]
Item	\$M	\$M	\$M	Notes
\$Repay-PV(2016)-Average	42.3	25.7	26.0	[5]
\$Repay-Total-PV(2016)	846	514	520	[6]
\$CapCon-PV(2016)	343	316	305	
\$Risk-Territory-PV(2016)	119	109	114	
\$PPPContract-2016	1,309	939	939	[7]
\$Repay-Total-PV(2016)+ \$Risk-Territory-PV(2016)	965	623	634	
\$Paypm-PV(2016)	48.27	31.16	31.16	[8]
\$Build-PV(2016)	618	618	618	[9]
\$Int-Build-PV(2016)	100	100	99.61	[10]
\$O&M-PV(2016)	591	222	222	[11]
\$O&M-PV(2016)/\$Build-PV(2016)	96%	36%	36%	[12] [13]
Notes:				
1. %Discount rate applied by ALSC				
2. %Discount rate applied by Cap Metro, according to A-G Report, to get \$939M PV(2016) for PPP Contract				
7.52% is presumed to be the real interest rate paid on loans by the contractor during build phase				
3. %Discount needed to get \$339M PV(2016) for PPP Contract				
4. Build phase of 3 years to discount from 2019 (start of contract) to Jan16 (Business Case Base Date)				
5. PV(2016) for average \$repayments over 20 years				
6. Total repayments PV(2016) - Exclude \$Capital Contribution				
7. \$939M is publicised figure for cost of PPP Contract (including \$Capital Contribution)				
8. Actual discounted monthly payment				
9. Published \$Build cost \$675M discounted to PV(2016) (excludes \$Interest paid on borrowed capital)				
10. \$Interest paid on borrowings during build phase; repaid through availability payments				
11. Best estimate of \$O&M PV(2016) cost				
12. Very important ratio, Used to estimate \$O&M for Stage 2				
13. The ratio of 36% is far too low and shows the fallacy of discounting at claimed 7.25%				

Stage 1 Patronage

Table A2B give details of Stage 1 patronage achieved to date. At its best, Stage 1 has managed about 4.6M boardings in a year (pre-COVID), with maximum, at-capacity boardings in the morning and evening rush hours. The Canberra Times reported (16May23) that Stage 1 clocked-up 892,501 ‘user trips’ in the December quarter of 2022. If extrapolated over the year, that would be 3.57 million for the year. However, both figures, being at capacity now at peak hours, are a long way from 4.76 million in 2021 and can never reach the 6.36M a year predicted in the Business Case²⁶. These latter figures were used as a major justification of Stage 1, with the current tram stock of 12 operational of 14.

²⁶ Complete Business Case Stage 1 Light Rail, ACT Government, [undated but probably 2016]



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TABLE A2B Light Rail Summary- Stage 1 Patronage & Revenue	Daily/Annual Multiplier		Years	
	315	[1]	20	
Patronage	2021	2022/23	2031	Notes
Daily Patronage	15,120		20,207	[1]
Annual Patronage	4,762,800		6,365,205	[1]
Patronage-(December quarter 2022)		892,501		[2]
Patronage-Annual (extrap)		3,570,000		
Fares & Revenue (Business Case)	\$M	\$M	\$M	
Fare revenue pa (2019-2039)	5.50			[1]
Fare revenue-PV(2019-2039)	4.00		81.00	[1]
Average fare per trip \$1.01				[1]
Current Fares (2023)		\$		
Current Adult fare (peak)		3.22		[2]
Average fare		2.50		[3]
Notes:				
1. Full Business case Table 46, Capital Metro, [undated but 2016 assumd]				
2. Canberra Times 16May23				
2. Capital Metro website				
3. Assumed 80% of peak fare [could be determined accurately if all data were known]				

Stage 2 cost rationale

The cost rationale for Stage 2 has been subject to a more detailed analysis of the complexities of the infrastructure required, to get a better handle on what these stages may well cost.

After physical inspection of the route to Woden and to Mawson, Table A3 details the most significant items of infrastructure required and assigned estimates for the construction of each.

Readers may get an appreciation from Table A3 of the complexity of Stage 2, compared to that encountered in Stage 1.

Readers may recall that the promise to extend light rail to Woden was an eleventh-hour brain-snap by the First Minister in his 2016 election campaign, obviously made without any consultation and, thus, without any concept of complexity or resultant cost or benefits.

Table A4 gives typical road build costs, according to a BITRE report, per Km/Lane. Its figures have been used here as a guide to the possible cost of earthworks that the track to Woden will require.



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TABLE A3		3% pa for 7 years	Constants	1.230	Esc factor 2016/2023
BUILD ONLY COST ESTIMATES		Reference	\$M/Km	\$M	Work
STAGE 2B - REGATTA POINT TO WODEN TOWN CENTRE		Stage 1 actual build cost (2016 prices) [1]	56.3		12Km Track & Stations
AND		Stage 1 actual build cost (2023 prices) [1]	69.18		12Km Track & Stations
STAGE 2B EXTENSION - WODEN TO MAWSON		Australian Cases (max) [2]		7.5	Intersection + Lights
		Australian Cases (min) [2]		4.0	
		BITRE Report (See Table A3)	4.7		Earthworks (signif)
		BITRE Report (See Table A3)	6.6		Earthworks (major)
		BITRE Report (See Table A3)	8.4		Earthworks(extens)
1. Based on actual contracted build cost of \$675M (2016 prices)					
2. Sunshine Coast Council (up to \$5M); Victorian government (\$5M to \$11M)					
Stage Leg	Km	Work required	Build Estimate \$M	[note] Comments	Stops
Stages 2A, 2B + 2B Extension to Mawson	13.6	\$141.54M per Km	1,877		
Stages 2A, 2B	11.6	\$153.66M per Km	1,715		
Stages 2A	1.5	\$365.25 per Km	354		
All Track + Stations			104		
Raising London Cct			100	[1]	
Bridge over Parkes Way			100	[2]	
Acton Waterfront			50	[3]	
Stage 2B + 2B Extension to Mawson	12		1,524		
Stage 2B			1,361		
All Track (10.1Km) + Stations	10.1	[Assumes graded right-of-way]	699		
Regatta Point to Comm Ave bridge	0.25	Earthworks (significant)	1		
Reworked intersection and traffic lights			8		1. Hyatt Hotel
Bridge across lake	0.3		300	[4]	
Lake to State Cct	1.25		13		
Leaves Cth Ave at Coronation Dve		Intersection and lights	8		
Along left side of Cth Ave to State Cir		Earthworks (significant)	6		
State Ctr to Adelaide Ave	2.3		72		
To State Cir		Earthworks (significant)	11		
Over State Cir to inside thereof		Intersection and lights	8		
Under two Mall bridges		MUST fit - work on bridges not feasible			
To Kings Ave		Intersection and lights	8		2. Kings Ave
To Sydney Ave		[no intersection]			3. Sydney Ave
To Canberra Ave		Intersection and lights	8		
To Melbourne Ave		Intersection and lights	8		4. Melbourne Ave
To Capital Cir (under or over?)		Bridge or Intersection and lights	20	[5]	
Up onto Adelaide Ave (centre)		Earthworks (significant)	11		
Along centre of Adelaide Ave	2		119		
To Yarra Glen		Earthworks (significant)	9		
To Hopetoun Cct bridge (Over)		Centre bridge span required	50	[5]	5. Hopetoun Cct
Ditto		Footbridge/elevator access	20	[5]	
Novar St bridge (under)		Rework of bridge supports possible	20	[5]	6. Novar St
Ditto		Footbridge/elevator access	20	[5]	
Along centre of Yarra Glen	2.75		28		
Yarra Glen/Yamba Dve roundabout		Earthworks (major)	18		
Carruthers St bridge		Rework of bridge supports needed	10	[5]	7. Carruthers St
Across roundabout 0.75 km	0.75		106		
Across culverts etc		Earthworks (extensive)	6		
Ditto		Bridging (extensive)	100	[5]	
Launceston St to Bradle St	0.5		15		8 Canberra College
Callum St		Intersection and lights	8		
Bowes St		Intersection and lights	8		
Town Centre					9 Terminal Woden
Stage 2B Extension to Mawson (2Km)		\$71.5M per Km	162		
All Track (2Km) + Stations	2		138		
Extra work			24		
Bradle St to Neptune St		Intersection and lights	4		
Neptune St to Corinna St		Intersection and lights	4		10. Parramatta St (?)
Corinna St to Hindmarsh Dve		Intersection and lights	4		
Centre of Athlon Dve to Shea St		Intersection and lights	4		
Centre of Athlon Dve to Melrose Dve		Intersection and lights	4		
Centre of Athlon Dve to Mawson Dve		Intersection and lights and Terminal	4		11 Terminal Woden
Notes:					
1. Expected \$100M for raising London Cct plus traffic lights.					
2. Estimate only					
3. Auditor-General report says \$23M in 2019, discounted at %7pa. Therefore, \$30M in 2023 But this figure is highly suspect, so use \$50M					
4. Estimate only but based on anecdotal evidence					
5. Estimate only					



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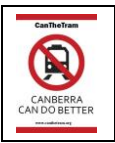
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Table A4		2016 to	Escalated	Years	7
Road Build Costs		2023		%Escpa	3%
Table R.4 Average per unit project cost by road class Cost					
Cost	Class 1	Class 2	Class 3	Class 6	Class 7
	(\$ per lane kilometre)				
Average total cost.	6.64	4.67	1.23	8.36	7.75
SD	4.92	2.58	1.48	10.08	5.29
Standardised average cost**	6.15	4.06	1.11	7.63	7.38
SD	4.92	2.21	1.35	9.10	5.04
**. Average total cost less property acquisition and supplementary costs					
Source: BITRE based on data provided by jurisdiction 2017 costs)					
Bureau of Infrastructure, Transport and Regional Economics (BITRE)					
Road Construction Cost and Infrastructure Procurement: 2017 Update					
Level	Use (Rounded)				
Earthworks (significant)	Class 2	4.70			
Earthworks (major)	Class 1	6.60			
Earthworks(extensive)	Class 6	8.40			

Overall Estimates

Overall detailed cost estimates are provided at Table A5 for all stages.

Estimates for possible stages beyond Stage 2 are indicative only.



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21-May-23		Assumptions				%O&M high maintenance items				Assumptions							
LIGHT RAIL - CANBERRA MATES - NETWORK		Cost	%IntReal	\$Int(20)/\$Prin	%O&M/\$Build	%O&M for low maintenance items				Sinterest-Build							
As calculated by Bloon_21Sep22.xls		\$CapC	2.00%	0.214	96.00%	Capital contribution by ACT in 2019				Stage	Ys-to Build	%Int-Loan					
		\$Build-1	3.00%	0.331	5.00%	Contract \$Cost-Build in 2019 \$0.76 B in 2023 prices.				1	3.00	7.25%					
				[6]						2A	4.00						
										2B	6.00						
										2BExt	2.00						
														Escalation 2016-23		Includes \$Int on \$CapC	
														Years @	%pa		
														7	3%		
Route	Program		[1]	[2]	Program	2016	2016	2016	2016	2016	2016	2016 [6]	2016 [7]	2023	2023 [8]	2023 [9]	
Route	Notes	Length KM	Patrons pa Millions	Build Factor	2016 [3] \$B	2016 [4] \$B	\$Bal \$B	%Int Applic? Y/-	\$Int \$CapC \$B	\$Int [5] \$Build \$B	Total Build \$B	O&M [20Y] \$B	PPP (20 Y) Contract \$B	PPP (20 Y) Contract \$B	Project Office \$B	Real Cost Taxpayer \$B [4]	
Gungahlin-Civic	[10]	1.2	4.6	1.00	0.675	0.375	0.300	Y	0.080	0.099	0.77	0.648	1.422	1.749	0.10	1.929	
Route	Notes	Length	Patrons pa		2023	2023	2023	2023	2023	2023	2023	2023	2023	2023	2023	2023	
Civic Woden + Mawson					1.877					0.621	2.499	0.950	3.449	3.449	0.150	3.599	
Civic Woden		11.80	3.5		1.715					0.568	2.283	0.816	3.099	3.099	0.150	3.249	
Civic - Comm Park		1.7	1		0.354	-	-			0.117	0.471	0.112	0.583	0.583	0.05	0.633	
All Track + Stations					0.104	-	-					0.100			0.05		
Raising London Cct	[11]				0.100							0.005			-	-	
Bridge over Parkes Way	[11]				0.100							0.005			-	-	
Acton Waterfront	[11A]				0.050							0.003			-	-	
Comm Park - Woden	[12]	10.1	3.5		1.361					0.451	1.812	0.704	2.516	2.516	0.100	2.616	
All Track (10.1Km) + Stations					0.699							0.671			0.10		
Regatta Point to Comm Ave bridge		0.25			0.001							0.000					
Reworked intersection and traffic lights					0.008							0.000					
Bridge across lake		0.3			0.300							0.015					
Lake to State Cct		1.25			0.013							0.001					
State Ccr to Adelaide Ave		2.3			0.072							0.004					
Along centre of Adelaide Ave		2			0.119							0.006					
Along centre of Yarra Glen		2.75			0.028							0.001					
Across roundabout 0.75 km		0.75			0.106							0.005					
Launceston St to Bradle St		0.5			0.015							0.001					
Town Centre		0										-					
Stage 2B Extension to Mawson (2Km)		2	3.5		0.162		-	Y		0.054	0.216	0.134	0.350	0.350		0.350	
All Track (2Km) + Stations					0.138							0.133					
Extra work					0.024							0.001					
Belconnen - Civic	[13-15]	13	4.5	1.20	0.878	-	-			0.127	1.005	0.84	1.85	2.27	0.10	2.37	
Civic-Russell	[13-15]	4	1	1.00	0.225	-	-			0.033	0.258	0.22	0.47	0.58	0.05	0.63	
Russell- Canberra Airport	[13-15]	4	1	1.10	0.248	-	-			0.036	0.283	0.24	0.52	0.64	0.05	0.69	
East connection (Capital Hill-Fyshwick)	[13-15]	4	1	1.50	0.338	-	-			0.049	0.386	0.32	0.71	0.87	0.05	0.92	
Mawson-Tuggeranong (Athllon Corridor)	[13-15]	8	3.5	1.30	0.585	-	-			0.085	0.670	0.56	1.23	1.51	0.10	1.61	
Civic-Molonglo-Weston Creek-Woden	[13-15]	19	2.5	1.30	1.389	-	-			0.201	1.591	1.33	2.92	3.60	0.15	3.75	
Network 1-8		75.8	21.6		6.1	0.4	0.3				1.198	7.250	4.98	12.23	14.68	0.75	15.51

Stage 1 patronage based on actuals for 2019-22; Stage 1 Business Case estimated patronage at 6.3 million pa (Table 46)
 Patronage for other stages based on Stage 1 achievement. Civic-Woden will be lower than Stage 1 because tram will double commuter time.
 Build factor = complexity of build, relative to Stage 1, affecting cost. Stage 2 components separately estimated.
 PPP build cost is assumed funded 100% by borrowings and will incur in interest cost over 20 year O&M period)
 These figures for Stage 1 are 2016 figures escalated 7 years to 2023 at an assumed 3% pa. Actual escalation provided for in the PPP contract is not known due to contract confidentiality.
 One would need to study current budget provisions to see how annual repayment have changed since 2016.
 Interest paid over 20 y on equity and borrowings by build contractor.
 O&M cost over 20 Y, as ratio of build cost - based on earlier cost modelling for Stage 1. 96% for track and trams; 5%pa other infrastructure like bridges.
 PPP contract cost (excludes project office)
 Project Office activity costs for PPP contract and of non-PPP contracts such as for consultants
 Total cost to taxpayers (includes project office)
 Build cost of \$675M reported in 2019 at Commissioning
 Minimum construction cost Stage 2A includes \$100M to raise London Cct; and \$50M for bridging Parkes Way
 \$50M allowed for Action Waterfront which A-G report on Stage 2A said should be included in cost of Stage 2A
 Minimum construction cost Stage 2B; includes \$300m for Commonwealth Ave bridge, subject to and determined by NCA.
 Minimum construction cost Stage 2B also includes several other infrastructure works along the route. See TableA2 for details.
 Estimates based on Stage1 and 2 costs, respective distances and relative build complexity.
 Interest cost assumes same percentage as for Stage 1.
 O&M estimates assume same percentage as for Stage 1.