ACT LIGHT RAIL COST ESTIMATES

Purpose

This document provides and discusses the latest independent cost estimates for ACT light rail Stages One and Two (LRS1; LRS2), based on relevant information released by the Government, reports in the media and on independent life-cycle cost analysis. Both Commonwealth Ave and Kings Ave LRS2 options (LRS2(CthAve) and LRS2(KingsAve)) are covered. Included is the structure and rationale for cost components identified.

Assumptions

Estimates presented in this paper rest on the assumptions listed in Table 3 of Annex A.

In respect of LRS2(CthAve), the ACT Government's initial submission to the JSCNCET[1] (S5.8) says that "*The project's capital value is currently anticipated to be in the region of $1.3 to $1.6 billion, …"*, but does not define the term "capital value". In its first supplementary submission to the JSCNCET[2], Figure 4 gives the 'Capital cost estimate' for LRS2(KingsAve) at $1.53 billion to $1.9 billion. At S6.2 of this same reference, it clearly states that "*That amount relates to construction and light rail vehicle costs only. It does not take into account:*

- *Additional operational costs associated with operating and maintaining the lengthier system …*
- *Any associated additional financing costs".*

Consequently, estimates in this paper for the LRS2 options are based on the Assumption 1A, namely that *"As for LRS1, the construction costs for LRS2 options cited by the Government do not include the cost of capital."*

Nevertheless, clarification of the definition of 'capital value' has been sought from Transport Canberra. In the meantime, Assumption 1B "*Contrary to LRS1, the 'capital value' of LRS2 options cited by the Government includes the cost of capital."* has not been invoked nor considered further in this paper.

As a general comment on assumptions, even though they may be considered reasonable and robust, assumptions are often the first target of critics attempting to discredit estimates. Except for minimum and most probable values determined, there has not been any sensitivity analysis[3] done in respect of these assumptions. Such could be done if need be.

Definitions and Interest Calculations

Some relevant definitions are given at Table 7.

The methodology for the calculation of interest payable on various capital borrowings are provided at Table 8.

References

See footnotes.

Summary

Estimates-Based on Assumption 1A

Initial estimates for LRS1 and LRS2 (both options) are summarised here in Table 1A and are based on Assumption 1A at Table 3, Annex A. Respective, detailed estimates are shown at Annex A.

[1] JSCNCET Submission 25: Gungahlin To Woden (via Barton) Light Rail - Submission to the Joint Standing Committee on the National Capital and External Territories, ACT Government, 25Jun18 [Section 5.8]

[2] JSCNCET Submission 25.1: Gungahlin To Woden (via Barton) Light Rail – Supplementary submission to the Joint Standing Committee on the National Capital and External Territories, ACT Government, 31Jul18, Figure 4.

[3] Given that a quantitative estimate will be a mathematical function of one or more variables, sensitivity analysis refers to the use of two or more values of one or more of the variables in the function, about respective means, to determine the effect on the output of the function.

Table 1 Light Rail Cost Estimates - Summary	LRS1	12 km	LRS2 Cth Ave	12.1 km	LRS2 Kings Ave	13.6 km
Cost component 2018 prices	**Min** **$M**	**Prob** **$M**	**Min** **$M**	**Prob** **$M**	**Min** **$M**	**Prob** **$M**
$Cost-Contract	**984**	**1,137**	**2,671**	**3,219**	**3,103**	**3,772**
$Service Payments-Contract pa (over 20Y)	49	57	134	161	155	189
$ Cost-Project-Taxpayer (25Y)	**1,676**	**1,830**	**2,771**	**3,319**	**3,203**	**3,872**
$ Cost-Project-Taxpayer - average pa (25Y)	67	73	111	133	155	189
Patronage	**millions per annum**					
Passengers pa - Maximum	6.3	6.3	6.0	6.0	4.8	4.8
Subsidy per passenger	**$**					
$Subsidy-Passenger [through 20-year contract period]	13	15	23	28	33	40

Light Rail Stage 1 (LRS1)

The Government has always published the contract cost of LRS1 as $939 million, in January 2016 prices. If this figure is escalated to December 2018 at the average inflation for the period of 1.8 per cent[4] over three years, the contract cost would be $991 million, which is virtually the same with and, so, validating the $984 million determined here for LRS1.

However, there is a large difference between the estimated contract cost ($984 million) and the total project cost to the taxpayer ($1,676 million). This is primarily due to the fact that the contract cost does not include the Capital Contribution ($375 million) that the Government is committed to pay upon commissioning of the system, nor the opportunity cost of that contribution nor the costs of project administrative and non-contract consultancies let by the project office. See details at Table 4.

Although, at this date, LRS1 is almost a fait accompli, the Government has yet to justify the project in economic terms.

Light Rail Stage 2 (LRS2)

In the two cases of LRS2, there has not yet been any Capital Contribution mooted by the Government. Hence, the estimates for the cost of the contract and that to the taxpayer differ only by the administrative cost incurred by the project office. Except for the basic construction for each LRS2 option, as advised by the Government, there are no comparative figures available from the Government for the estimated contract cost nor the total cost to the taxpayer.

The Government has given the estimates of $1.3 billion to $1.6 billion for construction only of LRS2(CthAve) and an additional $300 million for LRS2(KingsAve), for a maximum cost of $1.9 billion. Because, as for LRS1, these figures are taken also not to include the cost of capital (very substantial – see Tables 5 and 6), the minimum estimated contract costs blow out to $2.671 billion and $3.219 billion respectively. LRS2 would impose a huge and untenable burden on the ACT budget of $134 million and $161 million per annum for 20 years, respectively, on top of the minimum average $49 million per annum already committed for LRS1.

The estimated contract costs for LRS2(CthAve) and LRS2(KingsAve) are some 2.7 and 3.3 times that for LRS1, respectively. Given maximum estimated patronages for both LRS2 options that are significantly less than for LRS1, the economics for LRS2 are very poor indeed, as may be seen from the subsidy per passenger figures in Table 1.

Estimates - structure

Unless otherwise mentioned, all dollar values cited are in December 2018 prices.

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

- for the contract - for construction plus 20 years of Operations and Maintenance (O&M);
- for the contract plus costs incurred by taxpayers outside the contract; and
- subsidies made for each passenger using light rail.

[4] Bureau of Statistics figure, 2Nov18.

Contract estimates comprise the following components:

- The cost of construction, normally over about three years: $707 million for LRS1. The contract would provide for escalation of costs throughout the construction period (20% assumed here for LRS1). Although the Government has said[5] that the contractor will 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) consumed during construction: This component is extremely important because it is not included in the basic construction cost but recoverable through the agreed annual Availability Payments[6]. 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 will be a combination of 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. In respect of equity funding, companies expect a certain 'return on investment' (normally significantly higher than cost of debt) which has also to be recovered under the contract, but, again, how is unknown because of contract confidentiality. Nevertheless, the nominal interest rate of 8.58 per cent and a real interest rate of 5.42 per cent used herein, and most likely used in the contract, have been independently determined by analysis of planned expenditures for LRS1 identified in the FY2018-9 budget.
- 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).

Non-Contract, project-related costs comprise the following components, (in addition to the contract itself):

- Any Capital Contribution made by the ACT Government, ie a lump-sum payment on commissioning of a stage: The Capital Contribution for LRS1 will be $375 million, but there has been no corresponding sum yet mooted for LRS2. Adding this to the contract cost gives the direct project cost [$ Cost-Project-Direct].
- Opportunity costs: If there is to be a Capital Contribution, there will be an opportunity cost incurred on that sum over the 20 years of the contract [$Cost-Opportunity of Capital Contribution (20Y)]. This cost is taken as the cost of government borrowing (a real rate of 3 per cent is assumed). Adding this component gives the real indirect cost to taxpayers of the project [$ Cost-Project-Indirect].
- Government administration costs: 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 main contract. In the case of LRS1, the cost of administration over five years from 2013 through 2018, is in the order of $150 million (verifiable by reference to consecutive ACT budgets). For LRS2, over a similar period, say 2017 through 2022, one could expect the administration cost to be in the order of $100 million and maybe more. Adding this component gives the real cost of the project to the taxpayer [$ Cost-Project-Taxpayer (25Y)].
- LRS1 has been contracted under a Private, Public Partnership (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.
- The question has often been asked why the Government did not choose to pay up front all of the $707 million construction cost when it is able to borrow money considerably cheaper than can a contractor. The net result is that ACT taxpayers will incur an estimated, unnecessary extra $68 million in interest

[5] Canberra Times, 27Oct18, "Final track laid at city end as builder to miss payments."

[6] Referred to as Service Payments in the ACT budget FY2018-19).

charges (2018 prices) for LRS1. The situation is much worse for LRS2, should the Government 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.

Light Rail Stage 1 (LRS1)

Estimates

LRS1 estimates are summarised in Table 2 and detailed in Table 4 at Annex A.

These independent estimates put the cost of the LRS1 contract ($Cost-Contract) at a minimum of $984 million to a most probable of $1,137 million, with average Availability Payments[7] over 20 years of from $49 million to a most probable $57 million per annum (2018 prices).

The Government has always given a published contract cost of LRS1 as $939 million, in January 2016 prices. If this figure is escalated to December 2018 at the average inflation for the period of 1.8 per cent[8] over three years, the contract cost would be $991 million, which is almost identical with and so validating the $984 million determined here for LRS1. Note that the estimate here of $436 million to $480 million for O&M has been estimated independently through life-cycle analysis techniques and correlate closely with corresponding Government figures contained in but not specifically identified as such in the ACT FY2018-19 budget[9].

However, with the inclusion of the $375 Capital Contribution, the interest opportunity cost on that sum and project administrative costs, the bill to ACT taxpayers grows to minimum of $1,676 million and a probable of $1,830 million, being an average of $67 million to $73 million per annum over 25 years, which has to be paid one way or the other (by taxes or debt) and all of which would come out of the infrastructure component of budgets, to the detriment of other more pressing demands on the public purse.

In respect of Availability Payments, the Canberra Times article of 26 October 2018[10], contained several pertinent statements from interviews with Government officials:

- "The exact monthly payments are commercial in confidence, but they range between $2.8 million and $4.7 million a month." [$33.6 million and $56.4 million respectively, over year].
- "Availability payments each month to a total of $47 million for the first year [$3.9 million per month average] will also be delayed until commencement[11]."

The foregoing figures cannot be reconciled with those listed in the FY2018-19 budget papers or Availability Payments published in the Contract Summary[12], which vary from $36.0 million in part-year 2019 to a maximum of $78.5 million in 2033, for total of $1,274 billion, ie an average of $63.7 million per annum. **Note** that these figures are in nominal terms, ie in future-year costs, so cannot be compared directly with 2018 prices, unless discounted to the 2018 base date.

We know, from detailed study of the FY2018-19 budget that Service Payments (Availability Payments) listed therein for FY2018-19 through FY2021-22, are virtually the same as project estimates made in January 2016

[7] The FY2018-19 budget talks of Service Payments while the earlier Business Case and Contract Summary talk of Availability Payments

[8] Bureau of Statistics figure, 2Nov18.

[9] The Contract Summary (June 2016) gives details only of the Availability Payments but do not separate these into the capital cost recovery component and the O&M component. The FY2018-19 budget separately identifies expected O&M costs for the Forward Estimates period only.

[10] "Canberra's light rail won't take passengers until 2019", Katie Burgess 26Oct18.

[11] Upon commissioning and acceptance of the system.

[12] Contract Summary, Capital Metro Agency, June 2016

and published in the Contract Summary of June 2016. Thus, there are three years of cost escalations (normally provided for in such contracts by way of agreed escalation indexes) to account for, as well as any 'unexpected' cost increases, claimable or otherwise under the contract, before correct costs to the budget are known.

From the inception of light rail, particularly since publication of the very problematical Business Case[13] in 2014, the ACT Government has been somewhat less than transparent on the real costs of LRS1 and prefers to invoke the convenient device of contract confidentiality. However, eventually, it needs to appropriate funds in budgets, unless it can find some way to hide costs off-budget. While the Government also published a version of the LRS1 contract, there was nothing of any real significance to be found therein about costs or payments, after being redacted.

There has been a great deal of criticism of light rail in the ACT since 2012, from government and private institutions, from independent analysts and from the ACT Auditor-General[14], all falling on deaf ears in the ACT Government, since its commitment to LRS1 after the 2012 election, as a condition of the Greens supporting a Labor government[15].

LRS1 Subsidies

Subsidies of LRS1 passengers are substantial and quite uneconomic for a 12 km tramline. Expected patronage for LRS1 is a maximum of 6.3 million per annum[16]. Throughout the 20-year contract period, the average subsidy will be from $13 to $15 per passenger. Over a 40-year economic life of the system, the subsidy would be $9 to $10 per passenger. Note that these figures, for one route only, are in excess of the prevailing subsidy per passenger of the entire ACTION bus network of about $8.60 in FY2017-18.

Justification

In the early days of LRS1, 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 0.49[17]. 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', eg clawback on the sale of real estate and ongoing rates. Critics of the project have always maintained that a Bus Rapid Transit (BRT) 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'.

LRS1 Conclusion

Although, at this date, LRS1 is almost a fait accompli, the Government has yet to justify the project in economic terms.

Light Rail Stage 2

Background

Stage 2 of light rail (LRS2) is intended to go from Civic to Woden, via Commonwealth Avenue, past the old Parliament House, with a dog-leg through Barton. It 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 LRS2. In its submission to the Committee, the ACT Government offered a cost estimate for the construction alone of LRS1 over Commonwealth Avenue bridge of from $1.3 billion to $1.6 billion, about twice that for LRS1, for a similar distance (12.1 kilometres). After its deliberations, the

[13] LRS1 Business Case, Capital Metro Agency, October 2014

[14] ACT Auditor-General's report: initiation of the light rail project, Report No. 5 / 2016

[15] Parliamentary Agreement for the 8th Legislative Assembly for the Australian Capital Territory, 2 November 2012.

[16] Derived from LRS1 Business Case, Table 46.

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

JSCNCET made six recommendations. While none of these specifically recommended a Kings Avenue route rather than via Commonwealth Avenue, it was implied that the former was preferred for a Barton circuit. Alternatively, it implied acceptance of a Commonwealth Ave route through the parliamentary triangle, if consistent with the National Capital Plan.

The first reaction of the ACT Government[18] was to resist the Kings Avenue route which, it said, would cost and additional $300 million in construction costs, ie from $1.53 billion to $1.9 billion[19], and sustain a considerable drop in expected patronage (20 per cent), so making the proposition even more uneconomic than the Commonwealth Avenue option.

Justification

After some four years of trying to convince Canberrans that Stage 1 has 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 it overall vision for Canberra, community sentiment, urban benefits and other factors*."[20] 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 Canberra ... and providing efficient, environmentally responsible public transport."*[21] 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.

LRS2 Patronage

In this analysis, patronage for LRS2(CthAve) has been estimated at a maximum of 6 million per annum and that for LRS2(KingsAve) 20 per cent less at 4.8 million, based on the Government's figure of 6.3 million pa in the Business Case for LRS1 (Table 46). The ACT Government's first supplementary submission to the JSCNCET (S4.0)[22] says that modelling of the Gungahlin-Woden route via Commonwealth Ave will "*achieve an average daily patronage of 39,000 people in 2036"*. It further says that "*Daily patronage for an alignment along Constitution Ave and Kings Ave is expected to be at least 20% lower than the preferred alignment over Commonwealth Ave.".* No modelling details are offered though. Patronage of 39,000 per day translates into 12.3 million per annum, less the maximum of 6.3 million per annum for LRS1 (expected to be the most highly patronised route) cited in the Business Case, gives the figure of 6 million per annum for LRS2(CthAve) and 4.8 million for LRS2(KingsAve).

LRS2 (Commonwealth Ave)

Estimates

LRS2 (CthAve) estimates are summarised in Table 2 and detailed in Table 5 at Annex A.

Construction alone will cost from $1.3 to $1.6 billion, given the Government's own figures [2018 prices assumed].

There being no mention yet of a Capital Contribution, all of the construction cost plus the cost of capital (equity and debt) will need to be recovered at commercial rates through Availability Payments over an assumed 20-year contract period, as was the case for LRS1. From Table 5, this cost (never mentioned by the Government) is quite substantial at $848 million to $1,043 million.

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[18] Canberra Times, 28Aug18. "ACT threatens to pull pin on light rail if forced to use Kings Avenue.

[19] JSCNCET Submission 25.1: Gungahlin To Woden (via Barton) Light Rail – Supplementary submission to the Joint Standing Committee on the National Capital and External Territories, ACT Government, 31Jul18, Figure 4.

[20] Canberra Times, 20 June 2018, "Cost of Canberra's light rail stage 2 revealed".

[21] 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

[22] JSCNCET Submission 25.1: Joint Standing Committee on the National Capital and External Territories Inquiry into Commonwealth and Parliamentary Approvals for the Proposed Stage Two of the ACT Light Rail Project - ACT Government Response to Questions on Notice, 31 July 2018.

In respect of the cost of O&M over the 20 years, that for LRS2 cannot be taken as a simple percentage of the capital cost, the two being only partially related. Rather, the O&M cost for LRS2 is based on what was determined independently for LRS1, but adjusted for obvious differences between the LRS1 and LRS2 systems. First, to comply with National Capital Authority (NCA) requirements, the LRS2 trams need to be battery driven rather that from overhead wires as for LRS1, the ongoing maintenance of trams and infrastructure of which is presumed to be marginally higher than for LRS1. Second, continually having to meet requirements set down by the NCA will have a cost. Third, there will be some cost involved in maintenance of a bridge, of no concern for LRS1. Consequently, the cost of O&M for LRS2(CthAve) is taken as 20 per cent higher than corresponding estimates for LRS1, being $523 million to $576 million, over the 20 years.

The contract cost for LRS2(CthAve), comprising components for construction, capital cost and O&M, is therefore estimated at $2.671 billion to $3.219 billion, all requiring cost recovery by way of Availability Payments over 20 years for an average of $134 million to $161 million per annum. LRS2(CthAve) would cost some 2.7 times that of LRS1, over about the same length of route.

Non-Contract Costs

With the addition of non-contract costs, the cost to taxpayers grows to $2.771 billion and most probably to $3.319 billion, for an average annual cost of $111million to $133 million, over 25 years.

Subsidies

The economics get worse when patronage is taken into account. That for LRS2(CthAve) is considered to be less than the 6.3 million per annum for LRS1 and is estimated here as a generous maximum of 6 million a year.

At this rate, the average subsidy for each passenger (boarding) would be $23 to $28, over the contract period, reducing to $14 to $17 per passenger, over the 40-year economic life of the system.

LRS2 (Kings Ave)

Estimates

LRS1 (KingsAve) estimates are summarised in Table 2 and detailed in Table 6 at Annex A.

Construction alone will cost from $1.53 billion to $1.9 billion, given the Government's own figures [2018 prices assumed].

There being no mention yet of a Capital Contribution, all of the construction cost plus the cost of capital (equity and debt) will need to be recovered at commercial rates through Availability Payments over an assumed 20-year contract period. From Table 6, this cost is very substantial at $998 million to $1,239 million.

As for LRS2(CthAve), the O&M cost for LRS2(KingsAve) is based on what was determined independently for LRS1, but adjusted for obvious differences between the LRS1 and LRS2(CthAve) systems. Consequently, the cost of O&M for LRS2(KingsAve) is taken as 10 per cent higher than corresponding estimates for LRS2(CthAve), giving $576 million to $633 million, over the 20 years.

The contract cost for LRS2(KingsAve), comprising components for construction, capital cost and O&M, is therefore estimated at $3.103 billion to $3.772 billion, requiring cost recovery by way of Availability Payments over 20 years of $155million to $189 million per annum. LRS2(KingsAve) would cost 3.3 times that for LRS1, for about the same length of route.

Non-Contract Costs

With the addition of non-contract costs, the cost to the taxpayer grows to $3.203 billion to $3.872 billion for an annual cost of $128 to $155, over 25 years.

Subsidies

The economics get very much worse when patronage is taken into account. That for LRS2(KingsAve) is considered to be some 20 per cent less than for LRS2(CthAve)[23], ie about 4.8 million per annum.

At this rate, the subsidy for each passenger would be $33 to $40, over the contract period, reducing to of $21 to $24 per passenger, over the 40-year economic life of the system.

[23] Canberra Times, 28Aug18. "ACT threatens to pull pin on light rail if forced to use Kings Avenue.

LRS2 Conclusions

From the foregoing, it can be seen that either route for LRS2 would be very uneconomic. This is especially so considering that any 'urban transformation' effect would be almost certainly less than for LRS1[24] and that technological solutions for BRTs and autonomous, steel-trackless trams are becoming available at a fraction of the cost.

Max Flint[25]
Co-ordinator, Smart Canberra Transport (SCT)[26]

9 November 2018

[24] Note that LRS1 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 for this measure.

[25] 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 many years was a private consultant, specializing in support systems and life cycle costing for major projects.

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ANNEX A TO
Light Rail Estimates_9Nov18_1.1

LIGHT RAIL COST ESTIMATES

Table 2 Light Rail - What it really costs - Summary	LRS1	12 km	LRS2 Cth Ave	12.1 km	LRS2 Kings Ave	13.6 km
Cost component **2018 prices**	**Min** **$M**	**Prob** **$M**	**Min** **$M**	**Prob** **$M**	**Min** **$M**	**Prob** **$M**
Contract						
$Cost-Construction - Nominal	706.7	848	1,300	1,600	1,530	1,900
$Interest-Real on borrowings	216	308	848	1,043	998	1,239
$Cost-Operations&Maintenance (20Y)	436	480	523	576	576	633
$Cost-Contract	**984**	**1,137**	**2,671**	**3,219**	**3,103**	**3,772**
$Service Payments-Contract pa (over 20Y)	**49**	**57**	**134**	**161**	**155**	**189**
Contract + Costs incurred outside contract						
$ Cost-Project-Direct	1,359	1,512	2,671	3,219	3,103	3,772
$ Cost-Project-InDirect	1,526	1,680	2,671	3,219	3,103	3,772
$ Cost-Project-Taxpayer (25Y)	1,676	1,830	2,771	3,319	3,203	3,872
$ Cost-Project-Taxpayer - average pa (25Y)	67	73	111	133	128	155
Patronage	**millions per annum**					
Passengers pa - Maximum	6.30	6.30	6.00	6.00	4.80	4.80
Subsidy per passenger	**$**					
$Subsidy-Passenger [through 20-year contract period]	13	15	23	28	33	40
$Subsidy-Passenger [after contract period]	4	5	6	6	8	8
$Subsidy-Passenger [40-year life] - Average	9	10	14	17	21	24

Table 3
Light Rail -Real Cost Estimats - Assumptions

SN	Assumption
1A	As for LRS1, the construction costs for LRS2 options cited by the Government do not include the cost of capital.
1B	Contrary to LRS1, the 'capital value' of LRS2 options cited by the Government includes the cost of capital.
2	Capital Contribution by ACT Government for LRS2 is zero.
3	Interest rate-Nominal on capital borrowings by contractor is 8.58% pa [determined by analysis of available project data].
4	Interest rate-Real on capital borrowings by contractor is 5.42% pa [determined by analysis of available project data]
5	Interest rate-Real on Government borrowings is 3% pa
6	Maximum of 4.8 million passengers pa for LRS2 (Kings Ave option). 20% less than Cth Ave option.
7	Maximum of 6 million passengers pa for LRS2 (Cth Ave option). Considered less than for LRS1
8	O&M costs for LRS2(CthAve) are 20 % higher than for LRS1.
9	O&M costs for LRS2(KingsAve) are 10 % higher than for LRS2(CthAve).
10	Risk (Build) is 20% over three years.
11	Risk (O&M) is 10%
12	System economic life is 40 years.
13	The capital cost of contractor equity is at the same rate as assumed for interest payable on debt.
14	Total project cost to taxpayers is spread over 25 years (2 years pre-contract; 3 years build; 20 years O&M.

Table 4		PV [1]	Risk (Build)	20%	Assump [2]
Light Rail -Real Costs - Stage1 (LRS1)		Dec-18	Risk (O&M)	10%	Assump [2]
SN	Cost component 2018 prices	Data	Minimum $M [3]	Probable $M [4]	Notes
1	**Basic Data**				
2	$Cost-Construction - Nominal		706.7	848.0	[5]
3	$Capital Contribution by ACT Gov		375.0	375.0	[5]
4	**$Capital recovery via Service Payments (20Y)**		**331.7**	**473.0**	[6]
5	Operations period - Contract (Years)	20			
6	Real Interest rate on capital borrowings	0			[7]
7	Nominal Interest rate on capital borrowings	0			[8]
8	**Estimates**				
9	**Contract**				
10	$Interest-Real on borrowings		216	308	
11	$Cost-Construction + $Interest on borrowings		**548**	**658**	[9]
12	$Cost-Operations&Maintenance (20Y)		436	480	[10]
13	**$Cost-Contract**		**984**	**1,137**	[11]
14	**$Service Payments-Contract pa (over 20Y)**	20	**49**	**57**	[12]
15	**Non-Contract**				[13]
16	$Capital Contribution (ACT Gov)		375	375	
17	**$ Cost-Project-Direct**		**1,359**	**1,512**	[14]
18	$Cost-Opportunity of Capital Contribution (20Y)		167	167	[15]
19	**$ Cost-Project-InDirect**		**1,526**	**1,680**	[16]
20	$Cost-Administration ($M)	150	150	150	[17]
21	**$ Cost-Project-Taxpayer (25Y)**		**1,676**	**1,830**	[18]
22	**$ Cost-Project-Taxpayer - average pa (25Y)**	25	**67**	**73**	[19]
23	**Subsidy per passenger**				
24	Passengers pa- Maximum - LRS1 (millions)	6.3			[20]
25	$Subsidy-Passenger [through 20-year contract period]	20	13	15	
26	$Subsidy-Passenger [after contract period]	100	4	5	[21]
27	$Subsidy-Passenger [40-year life] - Average	40	9	10	

Notes:

1. All costs are Present Values at December 2018
2. Assumptions based on extensive major project experience
3. Minimum costs based on published cost of construction.
4. Maximum costs - minimums escalated at assumed risks for construction and O&M.
5. Published figures for nominal construction cost and Capital Contribution.
6. Excludes cost of financing borrowed capital
7. 5.42% = real interest rate on capital, derived from data published in ACT Budget for FY2018-19.
8. 8.58% = nominal interest rate on capital, derived from data published in ACT Budget for FY2018-19.
9. $331.7M + $Interest over 20Y @ real 5.42% pa
10. $Cost-O&M, derived from ACT Budget for FY2018-19; supported by independent analysis.
11. $Cost-Contract excludes $Capital Contribution.
12. Average Service Payments pa over 20 years.
13. Non-contract cost incurred by the project.
14. Actual direct cost of project - excludes opportunity cost of Capital Contribution of $375m.
15. Opportunity cost of $375m capital contribution, at real rate of Government borrowing of 3%, 20 years.
16. Indirect cost of project (contract plus non-contract costs) (20y).
17. $150m Administrative costs incurred by the project office 2013-2018.
18. Total project cost to taxpayers.
19. Actual cost pa to taxpayers by way of taxes or government debt.
20. Maximum of 6.3 million passengers pa. Derived from data in LRS1 Business case Table 46.
21. Provides for $100 m upgrade of plant, equipment and systems in years 20-40.

Table 5		PV [1]			
Light Rail - Real Costs - Stage2 (LRS2) - Commonwealth Ave		Dec-18			
SN	Cost component 2018 prices	Data	Minimum $M	Probable $M	Notes
1	**Basic Data**				
2	$Cost-Construction - Nominal		**1,300**	**1,600**	[2]
3	$Capital Contribution by ACT Gov		-	-	[3]
4	**$Capital recovery via Service Payments (20Y)**		**1,300**	**1,600**	
5	Operations period (Years) - Contract	20			
6	Real Interest rate on capital borrowings	5.42%			[4]
7	Nominal Interest rate on capital borrowings	8.58%			[5]
8	**Estimates**				
9	**Contract**				
10	$Interest-Real on borrowings		848	1,043	[6]
11	**$Cost-Construction + $Interest on borrowings**		**2,148**	**2,643**	
12	$Cost-Operations&Maintenance (20Y)	20.0%	523	576	[7]
13	**$Cost-Contract**		**2,671**	**3,219**	[8]
14	**$Service Payments-Contract pa (over 20Y)**	20	**134**	**161**	[9]
15	**Non-Contract**				
16	$Capital Contribution (ACT Gov)		-	-	[10]
17	**$ Cost-Project-Direct**		**2,671**	**3,219**	
18	$Cost-Opportunity of Capital Contribution (20Y)		-	-	
19	**$ Cost-Project-InDirect**		**2,671**	**3,219**	[11]
20	$Cost-Administration ($M)	100	100	100	[12]
21	**$ Cost-Project-Taxpayer (25Y)**		**2,771**	**3,319**	[13]
22	**$ Cost-Project-Taxpayer - average pa**	25	**111**	**133**	[14]
23	**Subsidy per passenger**				
24	Passengers pa- Maximum - LRS1 (millions)	6.3			[15]
25	Passengers pa- Maximum - LRS2-Cth Ave (millions)	6.0			[16] [17]
26	$Subsidy-Passenger [through 20-year contract period]	20.0	23	28	
27	$Subsidy-Passenger [after contract period]	150	6	6	[18]
28	$Subsidy-Passenger [40-year life] - Average	40.0	14	17	

Notes:

1. All costs are Present Values at December 2018
2. Min and Max estimates (Cth Ave option) from ACT Government submission to JSCNCET
3. Assumption: zero Capital Contribution by ACT Government. None indicated at this time.
4. 5.42% = real interest rate on capital, derived from data published in ACT Budget for FY2018-19.
5. 8.58% = nominal interest rate on capital, derived from data published in ACT Budget for FY2018-19.
6. $Interest on capital borrowed at 5.42% real.
7. Assumed 20% higher than for LRS1- battery driven trams, bridge maint & Parliamentary Triangle costs.
8. Basic contrct cost
9. Average Service Payments pa over 20 years.
10. Assumed Capital Contribution is zero for LRS2
11. Actual project cost to taxpayers (20y).
12. Estimated $100m administrative costs incurred by the project office 2018-2023.
13. Total project cost to taxpayers.
14. Actual cost pa to taxpayers by way of taxes or government debt.
15. Maximum of 6.3 million passengers pa for LRS1. Derived from data in LRS1 Business case Table 46.
16. Maximum of 6 million passengers pa for LRS2 (Cth Ave option). Considered less than for LRS1
17. Canberra Times article 28Aug19 implies higher passenger estimates fpr LRS1.
18. Provides for $150 m upgrade of plant, equipment and systems in years 20-40.

Table 6		PV [1]			
Light Rail -Real Costs - Stage2 (LRS2) - via Kings Ave		Dec-18			
SN	Component	Data	Minimum $M	Probable $M	Notes
1	**Basic Data**				
2	$Cost-Construction - Nominal		**1,530**	**1,900**	[2]
3	$Capital Contribution by ACT Gov		-	-	[3]
4	**$Capital recovery via Service Payments (20Y)**		**1,530**	**1,900**	
5	Operations period (Years) - Contract	20			
6	Real Interest rate on capital borrowings	5.42%			[4]
7	Nominal Interest rate on capital borrowings	8.58%			[5]
8	**Estimates**				
9	**Contract**				
10	$Interest-Real on borrowings		998	1,239	[6]
11	**$Cost-Construction + $Interest on borrowings**		**2,528**	**3,139**	
12	$Cost-Operations&Maintenance (20Y)	10.0%	576	633	[7]
13	**$Cost-Contract**		**3,103**	**3,772**	[8]
14	**$Service Payments-Contract pa (over 20Y)**	20	**155**	**189**	[9]
15	**Non-Contract**				
16	$Capital Contribution (ACT Gov)		-	-	[10]
17	**$ Cost-Project-Direct**		**3,103**	**3,772**	
18	$Cost-Opportunity of Capital Contribution (20Y)		-	-	
19	**$ Cost-Project-InDirect**		**3,103**	**3,772**	[11]
20	$Cost-Administration ($M)	100	100	100	[12]
21	**$ Cost-Project-Taxpayer (25Y)**		**3,203**	**3,872**	[13]
22	**$ Cost-Project-Taxpayer - average pa**	25	**128**	**155**	[14]
23	**Subsidy per passenger**				
24	Passengers pa- Maximum - LRS2-Cth Ave (millions)	6.0			[15]
25	Passengers pa- Maximum - LRS2-Kings Ave (millions)	4.8			[16] [17]
26	$Subsidy-Passenger [through 20-year contract period]	20.0	33	40	
27	$Subsidy-Passenger [after contract period]	175	8	8	[18]
28	$Subsidy-Passenger [40-year life] - Average	40.0	21	24	

Notes:

1. All costs are Present Values at December 2018
2. Min and Max estimates (Cth Ave option) from ACT Government submissions to JSCNCET
3. Assumption: zero Capital Contribution by ACT Government. None indicated at this time.
4. 5.42% = real interest rate on capital, derived from data published in ACT Budget for FY2018-19.
5. 8.58% = nominal interest rate on capital, derived from data published in ACT Budget for FY2018-19.
6. $Interest on capital borrowed at 5.42% real.
7. Assumed Kings Ave option O&M is 10% higher than for Cth Ave option O&M.
8. Basic contract cost
9. Average Service Payments pa over 20 years.
10. Assumed Capital Contribution is zero for LRS2
11. Actual project cost to taxpayers (20y).
12. Estimated $100m administrative costs incurred by the project office 2018-2023.
13. Total project cost to taxpayers.
14. Actual cost pa to taxpayers by way of taxes or government debt.
15. Maximum of 6 million passengers pa for LRS2 (Cth Ave option). Considered less than for LRS1
16. Maximum of 4.8 million passengers pa for LRS2 (Kings Ave option). 20% less than Cth Ave option.
17. Canberra Times article 28Aug19 shows a decrease of 20 per cent in patronage for Kings Ave route.
18. Provides for $175m upgrade of plant, equipment and systems in years 20-40.

Table 7
Light Rail -Real Cost Estimates - Definitions

SN	Term	Definition
1	Capital Contribution	A lump sum paid to the contractor upon commissioning of the system
2	LRS1	Light rail Stage 1
3	LRS2 (Cth Ave)	Light rail Stage 2 (Commonwealth Ave option)
4	LRS2 (Kings Ave)	Light rail Stage 2 (Kings Ave option)
5	O&M	Operations and Maintenance
6	Passengers	Light rail fares sold
7	PPP	Private, Public Partnership (contracting arrangement)
8	Nominal Interest Rate	Average bank interest rate for industrial loans.
9	Real interest Rate	Nominal Interest Rate less average expected escalation (inflation) index.
10	Subsidy	Cost borne by ACT taxpayers

Table 8
Light Rail -Real Costs
Interest Cost on Borrowings

Variable	LRS1		LRS2				Comment
	Construct	Capital Contributio	Cth Ave Min	Cth Ave Probable	Kings Ave Minimum	Kings Ave Probable	
n	20	20	20	20	20	20	Years
i	5.42%	3.00%	5.42%	5.42%	5.42%	5.42%	%Int pa (Real)
P	332	375	1,300	1,600	1,530	1,900	$Principal
Ppa	16.59	18.75	65.00	80.00	76.5	95	$Principal pa
PV$	(1-(1+i)^-n)/i	(1-(1+i)^-n)/i	(1-(1+i)^-n)/i	(1-(1+i)^-n)/i	(1-(1+i)^-n)/i	(1-(1+i)^-n)/i	PV formula
PV$	12.03	14.88	12.03	12.03	12.03	12.03	from PV Tables
P*I pa	17.98	11.25	70.46	86.72	82.926	102.98	$Int pa nominal
PV $Int-Total	**216.28**	**167.37**	**847.64**	**1,043.25**	**997.61**	**1,238.86**	