+ This document is a working appraisal of the proponent's cost benefit analysis of the proposal. As the project has developed, more information has been provided, which may supersede or respond to questions arising from earlier assessments. This working appraisal was prepared in April 2010 as an input into the Project Assessment Brief prepared by the Office of the Infrastructure Coordinator.

WORKING ASSESSMENT FOR BENEFIT COST RATIO MODERATION

Project name	Melbourne Metro Stage 1 **-** East West Rail Tunnel (Western Leg) NOTE: Appraisal seeks joint consideration of Stages 4 (RREL) and Stage 5 (East West Tunnel (Western Leg)). However, these have been appraised separately
Project code	
Brief project description	A new tunnel running from South Kensington to Domain, via Parkville and Spencer Street Station and new stations that include Parkville and Domain, and additional platforms at Melbourne Central and Flinders Street.
Reported BCR @ 7%DR	2.5
Capital cost total	$3.5 billion (2008 – real)
% costs bid for (where relevant)	100%

Note: Victorian projects nominated by the former Government are being carefully considered for advancement alongside the new Victorian Government's infrastructure priorities and in the context of the Government's development of a new, outcomes-based metropolitan planning strategy. Cost estimates and technical analysis for Victorian projects indicated in this document are as submitted to Infrastructure Australia in 2009.

Overall Comments (relating to resubmitted economic appraisal)

The BCR in the revised submission has dropped from 2.5 to 1.8. Detailed economic appraisal adopts high cost scenario. However, the resubmitted economic appraisal provides a significant level of additional information that supports the initial submission.

Demand

The demand model was developed internally by the DoT and validated against an external model (Zenith) which was developed by Veitch Lister, the same model which underpins Victoria's transport plan. This model has been scrutinised to a high level and is in the public domain. The results were also independently reviewed by Meyrick and Associates. The discussion of the demand modelling refers to aspects, such as capacity constraints and the impacts of the global economic down turn, which gives added confidence. Sensitivity analyses on demand have also been undertaken. All of the macroeconomic and land use inputs to the demand model have been sourced in detail.

The demand forecasts are based on the following key considerations:

- demand forecasts indicate that the Metro would attract moderate increases in new rail trips compared with the Base Case base load, ie in 2017 new trips equivalent to 2% of the Base Case load, increasing to 8% in 2028 and 11% in 2046.
- the study optimistically assumes that of the new users 60% would come from car. The attraction of private vehicle travel is the door to door travel times. Rail is at a significant disadvantage due to station sitings and transfer penalties. This is a significant uptake. But the analysis assumes that significant demand for rail in the base case is suppressed and crowded off to road.
- In the base case and option it is assumed that 100% of trips would be undertaken in crowded conditions across the network and hence the project would not provide relief to crowding over the long term.

Economic appraisal

- The economic appraisal structure is robust and includes all the conventional items. Wider economic benefits (WEBs) account for 25% of the entire project benefits, or PV$1.1b, with decongestion, a conventional and the most important, benefit in the appraisal coming in at 33%.
- **Benefits to new users -** Most of the user benefits accrue to existing users, which would be expected. The project is attracting significant shift from car users however the analysis indicates negligible benefits to new users? New user consumer surplus not withstanding the use of the rule of the half accounts for only 0.6% of PV of total benefits or $PV24m. What this analysis is implying is that for those car users who are shifting to rail in the option, their trip by car door to door would be almost exactly the same as taking the train which includes wait, access times to the station and their place of work(however, once again there is no transfer penalty).

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- **Road decongestion -** decongestion as a result of the significant shift to rail drives the whole analysis. It accounts for nearly 33% of total benefits.
  - The analysis indicates that the decongestion benefits have been estimated internally in the Zenith model using ATC parameters.
  - The only demand disaggregation provided are trips. More detailed information on decongestion method and travel times road and rail would assist to understand the decongestion benefits further
  - Based on the rigour of the remainder of the study and justification of assumptions there is a level of confidence that decongestion has been estimated accurately. However, as mentioned there is no presentation of the trip time savings or detailed methodology algorithm of how decongestion was estimated. Assuming that 60% (unsubstantiated assumption) of new users come from private vehicle and the attractiveness of the new rail service must be supported by a disaggregation of time savings for certainty. No presentation of incremental time savings is provided. There is however uncertainty surrounding why there are negligible benefits to new users.
  - This question was subsequently addressed in correspondence between the Victorian Department of Transport and Infrastructure Australia, with the proponent responding as follows:

    "Treatment of diverted user benefits (new user consumer surplus) You drew attention to the fact that, while the "decongestion" benefits are significant (ref Table 12-5 p 164 of the Project Plan), the benefits to the diverted users are very small (0.1% of total benefits).
    As with many other aspects of the evaluation we have chosen to take a very conservative view of benefits. In our modelling, we were not sufficiently comfortable with the assessments of many of the savings that would accrue to new users to include them in the appraisal. In the real world the new users would be likely to enjoy travel time savings of 20 - 30 minutes. This would translate into a significant benefit stream : some back of envelope calculations suggest an NPV of the order of $600, some 10% of total benefits.
    Other benefits where we have been very conservative include:
    overcrowding disbenefits don't start kicking in until average train loads exceed 900 (this is well above the contractually defined definition of crowding ; clearly a level of discomfort is experienced earlier than this)
    assuming only 60% of new users divert from cars when the modelling suggests a number like 90%
    waiting times are weighted at 1.4 times the value of time (most literature suggests a weighting of 2)
    A less conservative treatment of these various issues could double the benefits."[1]

- **Crowding -** Much effort has also been placed on identifying the change in the proportion of trips which occurs under various crowding conditions. However, the crowding benefits are also negligible.

- **WEBs -** Removal of the wider economic benefits (WEBS) could drop the BCR to 1.2. No detail of WEB estimation has been provided and 25% appears high.

	1. Reported information (lift text directly if possible)	2. Supporting information provided (list key documents, not content)	3. Extra information required / requested / received	4. Benchmark / Questions / Things to look for	5. Assessment of variance or methodological weaknesses	6. Notes re: degree of variation to BCR (any calculation / reasoning)	7. One line summary of argument / rating	8. Rating
Guidance	"Cut and paste" text from proforma if possible	List supporting materials not included in proformas but included with bids (formally and informally)	List all information requested by IA: please note which materials were, and were not provided by jurisdictions	See below	Insert the explanation of any differences or issues with theory, methodology or data used by the jurisdiction	Use this column, if required, to explain any reasoning for making an assessment of the scale of impact on the BCR, using figures if possible	Please insert one sentence summary of argument and conclusion reached	Significantly overstated; slightly overstated; broadly neutral; slightly understated; significantly understated.
Robustness of demand forecast								
1. Has demand been modelled in a robust and 'bottom-up' manner?	Demand forecasts are regional and metro network wide. Rail patronage forecasts based on output of MITM model and road forecasts	MITM Model (rail) and Veitch Lister (road). Very little sourcing for demographic	Reference to best practice scenario	▪ Has demand been modelled by a reputable transport modelling organisation? ▪ Evidence of use of a city wide travel model which adds the proposal as a new option & measures diversions	There is evidence that the modelling approach is robust. However, a summary of the modelling outputs could be provided to assist understanding the demand forecasts. This would ideally comprise: • Assumed base case rail and road demand growth rates;	Nearly all the benefits of this project will be determined by the extent to which the project provides travel time savings and reliability benefits to existing users and decongestion benefits to road use stayers.	Demand forecasts have the ability to significantly affect the BCR. However, in the current situation the approach used should carry a degree of	Broadly neutral

[1] Victoria DoT email communication with IA 20 January 2009 (Subject: Economic Appraisals : further information), summarising teleconference 19 January 2009

	based on Veitch Lister model. Evaluation asserts that both models are based on the latest Melbourne land use, population and employment forecasts. However, no detail is provided on key assumptions. The appraisal does include performance of project against the key IA priorities and in turn presents significant analysis and detail in relation to population and employment forecasts. NB: The implicit growth rate in demand for rail travel is reflected in the estimated capacity improvements associated with the project. For example, on completion of RREL project capacity of metro rail services will increase from 43,200 passengers per hour (currently) to 65,700 passengers per hour with the project. There are also significant assumptions made in relation to capacity constraints on the rail system with the base case which will result in significant diversions to road and eventually suppressed demand. However, detail in relation to the timing and the extent to which the capacity constraints bind are not provided. However, there is a level of confidence surrounding these demand forecasts given the specific modelling approaches undertaken and detailed discussion of socioeconomic and demographic trends expected over the evaluation period.	and socioeconomic information underpinning the demand forecasts.		▪ How close to capacity is the service in the high AM peak hour ▪ Have different fare levels & elasticity been evaluated & will service offer customer VFM against alternatives?	• The base year for these projections; • Whether demand is forecast for peak period and, if so, the duration of the peak; • Appropriate annualisation factors; • Segmentation of demand into mode stayers, diverters and generated trips; • Identification of how demand stream is developed between forecast years (i.e. interpolation and extrapolation approach); • Evidence on the incremental impact on these demand segments; • Identification of penalties involved for all of outer vehicle travel components (especially for rail user CBA) • Identify the timing and extent of constraint of road and rail networks to the extent to which they lead to diversions onto road and suppressed demand with the base case. • Information as to whether suppressed demand is released as generated trips with the option. There is no information indicating whether the project would induce demand on rail or road. No evidence of testing of alternative approaches to achieving the benefits sought from the project	Decongestion is the major benefit component and further detail in relation to how decongestion is estimated through the Veitch Lister model would assist to understand this further. This in turn requires the following assumptions to be made explicit: - Estimated rail demand growth with the base case - Timing and extent of capacity constraints evidence by number of rail trips which are either diverted to car or bus with the base case and suppressed - The impact of this diversion on road vkts - The number of new rail trips with the option - Proportion of these new rail trips which have diverted from bus/tram/car - The impact of this diversion on network service kms travelled by mode Demand forecasts have the ability to significantly affect the BCR. However, in the current situation the approach used should carry a degree of confidence.	confidence.	

2. Are the underpinning residential, employment and economic growth figures robust?	Evaluation asserts that both models are based on the latest Melbourne land use, population and employment forecasts. However, no detail is provided on key assumptions. However, appraisal does include performance of project against the key IA priorities and in turn presents significant analysis and detail in relation to population and employment forecasts. Do not know whether these have been incorporated into the demand forecast. There is a level of confidence in the robustness of these factors underlying the demand forecasts given the detailed discussion of socioeconomic and demographic trends expected over the evaluation period and the fact that it is asserted that the latest employment and population forecasts have been used. However, the forecasts may be optimistic and there is no benchmarking of these forecasts	Very little sourcing for demographic and socioeconomic information underpinning the demand forecasts.	Reference to best practice scenario	▪ Are current State or ABS projections used? ▪ Are central growth forecasts used? ▪ Are the transport demand forecasts directly linked to this data?	Ideally, we would like a summary of employment, land-use and population growth assumptions which have been included in the respective transport models for road and rail.	While there has been extensive discussion of expected trends in land use, economic development, population and employment as part of the priority analysis there is no clear direct linkage between these data and those that were eventually used in the transport modelling. The forecasts for population, land-use, economic development and employment, which drive the demand forecasts, could be optimistic. For example, it is estimated that with the Metropolitan Rail Network Development Program which includes the RREL, passenger demand will reach close to 60,000 passengers on the suburban rail network. Without the projects, only 35,000 passengers per hour will be accommodated (i.e. demand will nearly double). Therefore, the BCR may be slightly overestimated.	As the socioeconomic and demographic drivers of the demand forecasts may be optimistic relative to the base case, the BCR may be slightly overestimated.	Potentially slightly overestimated.
3. Achievability of the demand forecast?	Assumes a significant increase in peak demand for the Northern Group of 7.8% between 2007 and 2021. Also assertions relating to the capacity of rail services in the base case. However, these have not been explored quantitatively. Identified significant growth in Melbourne rail system of 23% based on the last 2 years only. No	See questions 1 and 2 above.	The achievability of the socioeconomic and demographic projections would be clearer if the study presented the impacts of high low and medium scenarios.	▪ Is the forecast justified by an in-depth analytical paper? ▪ Is the forecast endorsed by independent Expert Peer Review? ▪ Does forecast feature a gradual ramp-up (i.e. >4yrs)? ▪ What % of patronage is induced demand (should typically be <20%) ▪ Forecast patronage has been benchmarked to be broadly consistent with outcomes achieved on similar services? ▪ Has the proponent factored the costs of greenhouse gas emissions into their economic planning, including obligations under the Carbon Pollution	The achievability of the socioeconomic and demographic projections would be clearer if the study presented the impacts of high low and medium scenarios. No sensitivity testing of demand.	Insufficient information to assess the impact on the BCR given the absence of scenario and sensitivity testing. But, given the discussion in question 2 above, the BCR could be slightly overestimated		Insufficient information

	discussion as to whether this is anomalous compared to historical growth. Strong patronage on the Northern Group is expected over the next four years. No mention as to whether and how this will be sustained over the evaluation period Capacity constraints with the base case assume that this growth will be realised and responded to with extra services along with a range of other initiatives which are in turn expected to cause further diversions to road. The achievability of the patronage forecasts are directly related to the population and employment assumptions, which again have not been benchmarked , tested or explicitly identified as they appear in the transport models.			Reduction Scheme?				
4. Sensitivity of BCR to demand	No sensitivity testing of BCR to demand	N/A	Ideally do a range of scenarios for both increases and decreases in patronage for various discount rates	▪ Does a 30% drop in demand significantly alter the BCR?	Ideally do a range of scenarios for both increases and decreases in patronage for various discount rates and link the patronage sensitivities to the assumed socioeconomic and demographic assumptions.	Insufficient information to assess the impact on BCR		Insufficient information
5. Is the base case realistic and fundable?	The Base Case includes a selection of projects. However, the benefits accruing from these projects were not claimed. No detailed information on the costs of these projects and the extent to which these projects would increase capacity of the network.	The basis for the inclusion of these projects is not justified, nor are their impacts	Identify specific projects which comprise the base case, associated cost and impact on baseline demand under a "do minimum" approach rather than "do nothing"	▪ What is Base Case patronage growth - is it in line with historical trends? ▪ From the available information, is the base case capex and patronage a likely scenario, or is it overly loaded or light?	In the absence of a defined base case, there is no way of assessing to what extent the baseline growth in demand with the base case can be accommodated. Evaluation rests heavily on the decongestion benefits that will be generated by attracting road travel in the base case to rail with the option , where road demand in the base case is a direct function of capacity constraints assumed given a suite of works assumed in the base case.	Not enough information regarding the base case projects to assess whether the capacity constraints will be realised. Thus, the base case may be more effective than presented, meaning the base case is slightly overstated.		Not enough information, but could be slightly overstated
6. Does hourly patronage profile match conventional AM & PM peak flows	No information as to what observations in the MITM and Veitch Lister are, meaning we do not know the annualisation factors.	N/A	Need traffic demand forecast observation to be defined e.g. e.g. peak one hour, daily etc. Annualisation factors.	▪ Is the model scaled up to full year in a justifiable manner (e.g. annual patronage is normally 250-300 times AM high peak hour)?	There should be a direct linkage between the defined forecast measure e.g. AM peak one hour and the associated annualisation factor.	Insufficient information.		Insufficient information

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Robustness of cost base								
7. Robustness of capex forecasts	High level itemisation of capital cost items. However, only a point estimate is provided and capital costs are not divided into these components.	No source or estimation approach	Capital cost breakdown by item, sourced Real escalation rate and source Identify any capital costs in the base case	▪ Is the capex estimate supported by significant in depth work? ▪ Was it produced by a reputable independent organisation?	Need to provide: • Capital cost breakdown by item, sourced • Real escalation rate and source • Identify any capital costs in the base case Note: No indication of whether capital costs are incremental. Need physical measures of the infrastructure e.g. track kms and associated unit rates	Any changes in the capital costs will have a substantial impact on the BCR.		Insufficient information
8. Robustness of opex forecasts	Very broad categories of O&M which seem incomplete	No source or estimation approach	Operating cost breakdown by item and unit costs, sourced Identify any opex in the base case	▪ Is the opex estimate supported by significant in depth work? ▪ Was it produced by a reputable independent organisation?	Study should be clear as to whether the O&M costs are incremental. Need detailed itemisation, quantities and unit costs. Identification of any major refurbishment or replacement costs needs to be provided	Present value total of O&M accounts for only 4% of total costs and hence is expected to be relatively inconsequential		Method not described, but likely to be broadly neutral
9. Consequential costs	All relevant direct costs have been included			▪ Are consequential costs to other parts of the network or other stakeholders taken into account? ▪ E.g. land acquisition, higher costs due to the need to maintain service continuity & / or constructing around live traffic				
10. Revenue treatment	Includes fare box resource correction No discussion of method used to derive this	No sources	Average fares by mode	▪ Is the treatment according to ATC guidelines and in line with best practice?	Best practice approach should identify average fare to incremental trips by mode. Fare box adjustment should be net of transfers between modes and net of operating costs by mode.	Not expected to have a significant impact on BCR as central case assumptions result in resource corrected fare box revenue accounting for 8% of present value of total benefits.		Method not described, but likely to be broadly neutral
11. Construction cost inflation	No construction cost inflation has been indicated			▪ Is the construction cost inflated by a margin above CPI (eg construction cost CPI)?				No moderation of BCR required
Key methodological questions								
12. Inflation rate	Not applicable			▪ What inflation rate is assumed and are any costs or benefits escalated by a different rate? ▪ Do values reflect realistic real wages growth (e.g. 1.5% per year)?				Broadly neutral
13. Time period used	30 years, but does not indicate whether from the first year of full benefits in 2019 or the base year	ATC	What is the base year When does the evaluation period commence	▪ Is the period of assessment valid given the lifespan of the project assets?	Best practice evaluation involves an evaluation period commencing with a base year which is the year in which the study was undertaken and the evaluation period commencing in the first year of opening	Insufficient information	Insufficient information	Broadly neutral
14. Residual value	Straight line depreciation except for land. New tracks and tunnel 50 year economic life and 30	N/A	Capital costs to be disaggregated by item. Exclude contingency and risk from residual	▪ Are residual values given when appropriate? ▪ Are the values used justified?	Best practice appraisal would identify the cost of each capex item and exclude contingency and risk from the residual	If we assume that it is applied to both contingency and risk then it will be slightly overvalued. However, given that the residual value is only 2%, the effect on BCR is likely to be broadly neutral.		Broadly neutral

	years for rolling (replacement staggered)							
15. Start and end timing, and phasing	Construction starts in in 2011 and ends in 2018. No information on when the evaluation period starts or construction phasing	No source	When evaluation starts and construction phasing and its rationale	▪ Does benefit stream period start at the commencement of operation and cost stream at first expenditure? ▪ Are construction costs ramped up in according with standard construction timetables?	Construction profiling should follow that of similar previous works and take account of risks and resource constraints. Construction phasing assumptions should be sourced. Should be explicit about when the evaluation period commences.	Insufficient information	Insufficient information	Insufficient information
16. Benefits allocation	All key benefit types included/estimated including wider economic benefits. Includes parking resource correction which should be theoretically included because it is a perceived cost.	General reference to ATC and Department of Transport Guidelines. Wider Economic Benefits from consultant study.	See best practice	▪ Is the rule of half correctly applied (e.g. to benefits from existing PT users who change modes)? ▪ Are all significant benefits identified? ▪ Are all beneficiaries identified (e.g. benefits of roads to non road users?)	Unlike stage 4 (RREL), this appraisal includes travel time savings which comprise 15% of total present value benefits. It is assumed that travel time savings are calculated only for existing rail users, however, this is not specifically identified. But once again the benefit to diverted users (i.e. from road modes) comprise an extremely low level of benefits (0.6%). Given that there are significant decongestion benefits (33%) this would require a significant level of diversion. The project estimates that the number of car trips would reduce by up to 60 000 per week day in 2036 with the project. Again, WEBs are added directly to the conventional benefits and comprise 25%. Exclusion of WEBs from the BCR reduces the BCR from 2.3 to 1.7 (note that this is calculated given the data provided and does not match the figure quoted in the report). WEBs should be excluded from the core BCA. Analysis should exclude parking resource correction as this is a perceived cost. Evaluation should ideally identify benefits in terms of above and below rail components. Parameter values for each line item should be identified. Algorithms should be provided for all benefit line items which relate travel demand to the economic parameter. The evaluation should identify whether and what penalties are applied to out of vehicle travel time to develop generalised trip cost. Identify and apply penalties for travelling in crowded conditions. Benefits of reliability should be defined and estimation methodology detailed. Decongestion benefits for existing road users are the largest line items. Parameter values should be identified for these.	The exclusion of WEBs (which are highly uncertain given the information provided) and the parking resource correction reduces the BCR by 28%.		Significantly overestimated
17. Sensitivity analysis – risks? (Capital costs - Construction duration - Operating costs - Discount rate at 10% - changes in oil price)	Sensitivity analysis of costs increasing by 40% at varying discount rates	N/A	Refer to best practice.	▪ Do the reported sensitivity tests, for instance to the price of oil, suggest significant risks surrounding the central case? ▪ How significant are +/-20% construction cost variations? ▪ Does economic viability become negative at a 10% discount rate?	Some key parameters in CBA subject to a high level of uncertainty and hence risk. The impact of alternative outcomes with these parameters on the BCR should be identified by way of sensitivity analysis.	The sensitivity tests undertaken, notwithstanding the discussion around benefit allocation above, shows that at a 7% discount rate, the BCR will decrease by 28% in response to a 40% increase in costs. This shows that the BCR is fairly robust. Therefore, likely to be broadly neutral.		Broadly neutral

18. Other methodological issues?	No ramp up of benefits. Assume full benefits in the first year. It is not clear whether there is generated demand. Demand model does not identify whether there is any generated demand. This is important because the benefits of generated demand are calculated according to the rule of a half New user consumer surplus does not identify whether it is diverted or diverted plus generated trips.			▪ Any there any other issues regarding the accuracy of methodology used that may significantly impact on the comparability of the BCR?		Requires appropriate demand ramp up		Slightly overestimated
Values benchmarking								
19. Value of time savings: business, non business, freight; and Vehicle operating costs	The parameters used have not been identified. There is a broad reference to ATC, but no way of knowing if they have been used and, if they have been used, if they have been used correctly Demand not segmented (i.e. trip purpose)	ATC	Identify parameters used	▪ Are the values used recommended by the ATC? ▪ Are these constant real through analysis period or do they factor in real growth (i.e. caution if real growth is >2%)	Benchmarking is a preliminary step in sensitivity analysis (See q 17). Need to identify parameters.	Insufficient information		Insufficient information
20. Value of carbon emissions	The value of carbon used have not been identified. There is a broad reference to ATC, but no way of knowing if they have been used and, if they have been used, if they have been used correctly	ATC	Identify parameters used	▪ Is there a nexus with the patronage forecast? ▪ Are the values used recommended by the ATC? ▪ Has the proponent calculated the direct emissions of their proposal? (i.e. include all carbon emissions from the construction or operation of the structure ▪ Has the proponent calculated indirect emissions of their proposal?	Benchmarking is a preliminary step in sensitivity analysis (See q 17). Need to identify parameters.	Insufficient information		Insufficient information
21. Death/injury/crash costs, physical fitness and health impacts.	The parameters used to calculate the benefits of reduced accidents have not been identified. There is a broad reference to ATC, but no way of knowing if they have been used	ATC	Identify parameters used	▪ Are the values used recommended by the ATC?	Benchmarking is a preliminary step in sensitivity analysis (See q 17). Need to identify parameters.	Insufficient information		Insufficient information

	and, if they have been used, if they have been used correctly							
22. Noise, particle emissions and other environmental pollutants (NOX, NMVOCs, SOX, CH4, N2O) Noise impacts	The parameters used to calculate the benefits of reduced accidents have not been identified. There is a broad reference to ATC, but no way of knowing if they have been used and, if they have been used, if they have been used correctly	ATC	Identify parameters used	▪ Are the values used recommended by the ATC?	Benchmarking is a preliminary step in sensitivity analysis (See q 17). Need to identify parameters.	Insufficient information		Insufficient information