Appendix A: Background

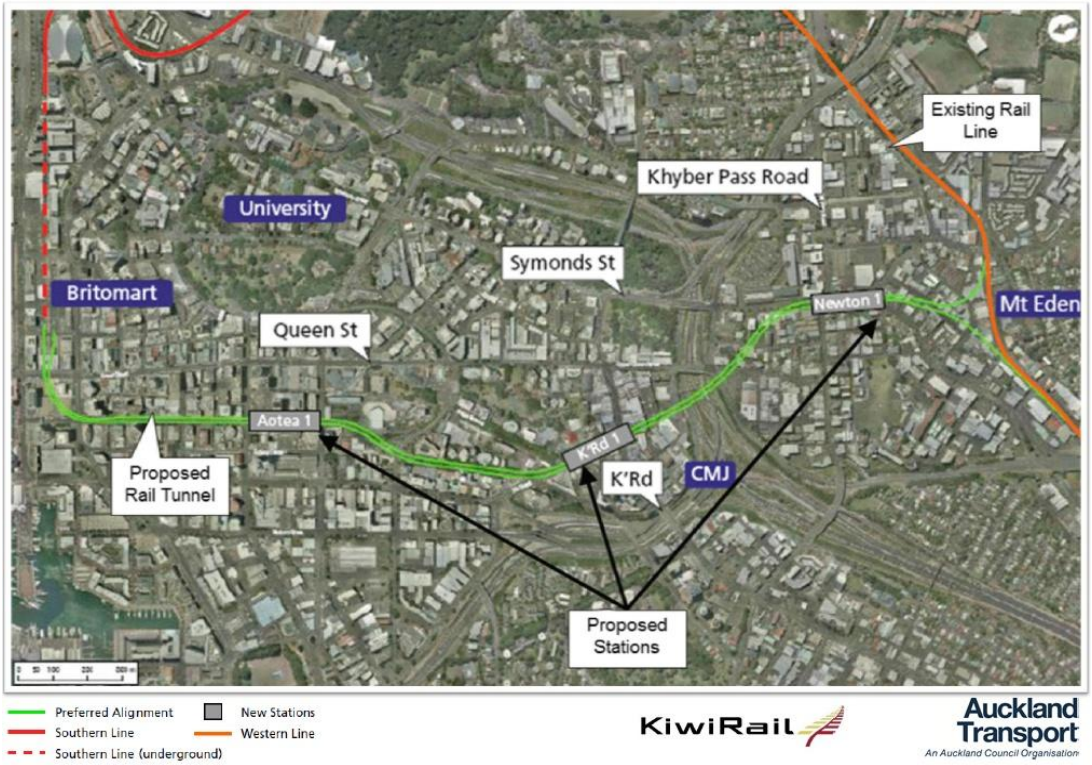
1.1 Review purpose

Following receipt of the Business Case on 19 November 2010 the Minister of Transport asked the Ministry of Transport to lead a review of the Business Case with the Treasury. The Minister agreed that the Ministry of Transport should convene a working group comprising the Treasury, the NZ Transport Agency (NZTA), KiwiRail, Auckland Council and Auckland Transport. The Ministry of Transport and the Treasury were also asked to provide advice to ministers on the merits of the City Centre Rail Link (CCRL) as a transport and economic investment and when the project might be required. Consultants provided technical expertise in specific areas of the review.

1.2 Project description

The proposed link is a 3.5 kilometre double track underground rail line running beneath the Auckland CBD from Britomart to the Western (North Auckland) Line near Mount Eden Station. Britomart would become a 'through' station, and three new intermediate stations (Aotea, Karangahape Road and Newton) would be constructed. Figure 2 below illustrates the overall route and the proposed station locations.

Figure 2: Proposed station locations



1.3 Purpose, origins and scope of the Business Case

Given existing congestion around the CBD and expectations of increased activity and employment within the CBD, the Business Case examined the benefits the project would provide by increasing passenger rail access to the CBD. The project is seen by Auckland Council as an important component of a package of measures required to support and promote growth in the productivity of the CBD and its social amenity, and as such to contribute to Auckland's growth as a whole.

The background to the Business Case is important to understanding its timing and content.

On 1 May 2008 the Minister of Finance under the previous government, wrote to the chair of NZ Railways Corporation (now part of KiwiRail) stating:

> *"In my view it is in the long term public interest to secure and protect the CBD tunnel route, even though construction may not take place for many years...it is appropriate for ONTRACK to assist in the protection of the CBD tunnel route by acting to protect the route at the earliest appropriate opportunity"*.

This request was a response to the former Auckland City Council's granting of a non-notified consent for a property development which could have compromised the future construction of the proposed tunnel. The route has no formal designation although it is mentioned in a range of planning documents.

In June 2009, following an open procurement process between the Auckland Regional Transport Authority (ARTA) and KiwiRail, KiwiRail gave approval for a contract to be signed with a consortium of Aecom, Parsons Brinckerhoff and Beca (APB&B) for the investigation and design of the CCRL. KiwiRail and ARTA shared the costs of the Business Case and the NZTA provided a 60 percent subsidy for ARTA's share of costs. The objective of the study was to "produce Notice of Requirement documentation of a quality sufficient to support designation of the route".

Assessment of various CCRL route options and the number and locations of stations was undertaken from August 2009 to February 2010, when the preferred option was approved by ARTA and KiwiRail and endorsed by the former Auckland Regional Council, the Auckland City Council and the Auckland Regional Transport Committee.

Subsequently in July 2010, following an initial business case stakeholder workshop[3] in May, APB&B's brief for the Business Case was extended to undertake a review of the CBD demographic trends and associated transport demands over the next 30 years, together with an assessment of possible options for meeting these demands.

The evolution and timing of the Business Case's development has meant that it does not contain some core elements set out in the NZTA's Economic Evaluation Manual (EEM) and the Treasury's Business Case guidelines (see www.infrastructure.govt.nz/publications/betterbusinesscases), which are requirements that need to be addressed before funding can be considered by the government. These most notably relate to the lack of a broad problem definition (the whole transport challenge facing the CBD) and the consequential full investigation of alternatives. This is not an area of disagreement between central government agencies and Auckland Council and Auckland Transport but reflects the changing pattern of expectations of this work

[3] The workshop was attended by representatives of the Treasury, the Ministry of Transport, and the NZTA as well as the former Auckland Regional and Auckland City Councils,

through the last 3 years. Auckland Transport advises that the level of assessment of alternatives has been sufficient for Notice of Requirement under the Resource Management Act 1991.

1.4 Review process and methodology

The Review process involved a working group of the Ministry of Transport, the Treasury, the NZTA, KiwiRail, Auckland Council and Auckland Transport. The process was collaborative but it is important to acknowledge different views between central government officials and Auckland Council and Auckland Transport on key aspects of the transport and wider economic benefits analysis.

The terms of reference for the Review explicitly ruled out any investigation of funding and financing issues, and procurement approaches.

The Review was undertaken through nine workstreams focusing on different areas of the Business Case. For consistency, each workstream used the same assumptions including; the post-electrified metro rail network for the do minimum, the rail service pattern and rolling stock assumptions in the Business Case for the do something, the modelling tools set out in section 1.4.1.

1.4.1 Auckland modelling tools

Three models were used in developing the Business Case and undertaking this Review.

- The Auckland Public Transport (APT) model provides detailed forecasts of public transport patronage and associated benefits for the Auckland region. APT was used as the basis for rail patronage forecasts and transport benefit estimates.
- The ART3 model is a strategic transport model that provides forecasts of travel for all modes across the Auckland region. This model provides input to the APT model. ART3 model results were used as a basis for assessing the wider economic benefits.
- The Auckland Strategic Planning model (ASP) is the Auckland region's integrated transport and land use modelling system (which includes the ART3 model). This was run to assess the employment location changes arising from the project.

The main model used, the APT model, was designed to help assess public transport projects like the CCRL. Both the APT model and the ART models have been calibrated for Auckland congestion conditions and used as inputs for other project assessments. The numbers presented in this report are therefore sufficient to provide orders of magnitude results on how the project will perform. Nevertheless, it is clear that a purpose-built model would be needed for more detailed analysis of CBD trips, particularly of congestion effects, and to take the project beyond the Business Case and this Review.

The Review compared the likely impacts of the do-minimum (the post-electrification network) with changes attributed specifically to the CCRL. The do-minimum includes allowances for the future impacts of proposed transport projects in the 2010 Auckland Regional Land Transport Strategy (ARLTS), excluding only the future major rail projects.

1.5 Strategic fit

Auckland Council and Auckland Transport consider completing the CCRL by 2021 is critical to address constraints in the rail, bus and road networks within the Auckland CBD and achieve Auckland's aspirations for a stronger CBD with significant employment, residential and tertiary student growth.

While the Review has primarily assessed the project's effectiveness and economic efficiency, it is also important to consider the 'strategic fit' of the CCRL. Strategic fit is one of the three main criteria used by the NZTA to assess and rank transport projects, along with effectiveness and efficiency. The CCRL will contribute to two aspects of the NZTA's strategic fit criteria: it helps reduce congestion in a major urban area, and it would help to strengthen and optimise operation of the rail network.

The NZTA assessed the project against its low/medium/high strategic fit criterion and considers that the project has a 'medium' profile. The NZTA considers this could change to 'high' once it is clear how the project fits with the Auckland spatial plan and if more evidence could be provided on land use integration, how the project will attract new patronage, reduce congestion and better integrate with buses and ferries.

Appendix B: Project costs

1.1 Capital costs of the City Centre Rail Link

Costs for the twin 3.5 kilometre tunnels (including stations, property purchase and contingencies) were reviewed using external experts. While a range of issues were identified and discussed, the Review concluded that the initial cost estimates and the anticipated time for completion, over a 10 year timeframe, were realistic.

The NZ Transport Agency (NZTA) and external consultants peer reviewed the capital costs. The conclusion was that there was more scope for cost reduction than escalation in the project. Undertaking considerably more investigation of the sub-surface along the route at an early stage was recommended, as this has been identified as a risk in the investigation phase. A sensitivity test for cost escalation was included in this review, reflecting international experience with cost growth in large infrastructure projects[4] (see Appendix G).

The tunnelling work was regarded as relatively mainstream industry practice although the Review made several suggestions to potentially reduce costs and risks, notably the use of competitive early contractor involvement.

1.2 Other rail network infrastructure capital costs

Additional rail network infrastructure is needed to support the expansion of the City Centre Rail Link (CCRL) services: additional train car sets, grade separation, other station upgrades and depot facilities and possibly signalling improvements.

The Review, based primarily on the knowledge of KiwiRail and Auckland Transport staff in Auckland's current rail upgrade and network electrification programmes, identified total additional costs of $155–165 million, plus an amount yet to be confirmed, if required, for additional signalling. This added some $20–30 million to the estimate in the Business Case after removing items assumed to be funded from alternative sources.

1.3 Operating costs

Under the Business Case assumptions the project would be operational from 2021, resulting in extra operating costs from running more trains, with a further increase in services from 2030. These include train operating and maintenance costs, track and tunnel maintenance, and station operating costs.

The Review incorporated the most recent data on operating costs of the metro network into a financial model agreed between the Ministry of Transport and Auckland Transport. These results were compared with the predicted operating costs in the Business Case, which were based on data provided by the Auckland Regional Transport Authority in May 2010.

The Review estimated that operational costs from 2021 would be $8.9 million per annum (pa) higher than the Business Case (in total an $18.1 million pa increase on

[4] in Flyvbjerg, B: "*From Nobel Prize to project management: Getting Risks right",* August 2006 Project Management Journal

current operating costs), and $17.5 million pa above those in the Business Case from 2030 (in total an increase of $36.8 million pa).

Table 2: Business Case and Review cost comparison

All estimates in 2010 dollars	Business Case ($ million)	Review ($ million)
CCRL construction costs (expected estimate)	1,991	1,991
Additional rolling stock required at opening	240	240
Other rail infrastructure costs	100	120-130
Total capital costs at opening	**2,331**	**2,351-2,361**
Operating costs additional to the do minimum	9.2 pa from 2021 19.3 pa from 2030	18.1 pa from 2021 36.8 pa from 2030
Further rolling stock required in 2030	260	260
Total net present value of costs	**1,580**	**1,699**

1.4 Construction impacts

Construction of the CCRL will involve disruption at a range of sites, some for several years. Details are set out in the table below. Direct costs for traffic management have generally been included but the impact on traffic and associated disbenefits of construction have not been estimated.

The restrictions on Albert Street and Symonds Street in particular will affect public transport. The restrictions on what is called lower Albert Street (but includes Customs Street east – which takes bus traffic from the North Shore off Fanshawe Street) are likely to have significant vehicle traffic implications.

Table 3: Indicative road restrictions and closures [5]

Area	Project Start Date (month)	Project Finish Date (month)	Duration (months)
Albert Street (and parts of Wellesley Street and Victoria Street) restricted to two lanes (to build Aotea Station)	6	44	39
Mt Eden Bridge restricted to two lanes (to rebuild bridge with a greater span)	11	23	13
Symonds Street restricted to two lanes (to build Newton Station)	13	30	19
Lower Albert Street restricted to two lanes (to build cut and cover section of tunnel)	13	27	15
Porters Avenue shut (to divert NAL and construct road overbridge)	27	40	14
Lower Queen Street restricted to one lane (to build cut and cover section of tunnel)	27	33	7
Normanby Road shut (to construct road overbridge)	36	38	3
In addition, part of Beresford Square (including the give way turn onto Pitt Street) will be permanently closed to enable construction and operation of K Road station. The actual and potential traffic effects have been discussed in section 7.4 of the AEE, including methods to mitigate and manage the effects of construction traffic			

[5] Taken from the assessment of environmental effects prepared by APB&B.

Appendix C: Patronage and effectiveness

This appendix outlines the Review's assessment of the changes in travel patterns expected as a result of the City Centre Rail Link (CCRL) and the effectiveness of the project in providing capacity for travel into the CBD. It also discusses issues with the reliability of the rail network and the findings relating to the assessment of alternatives.

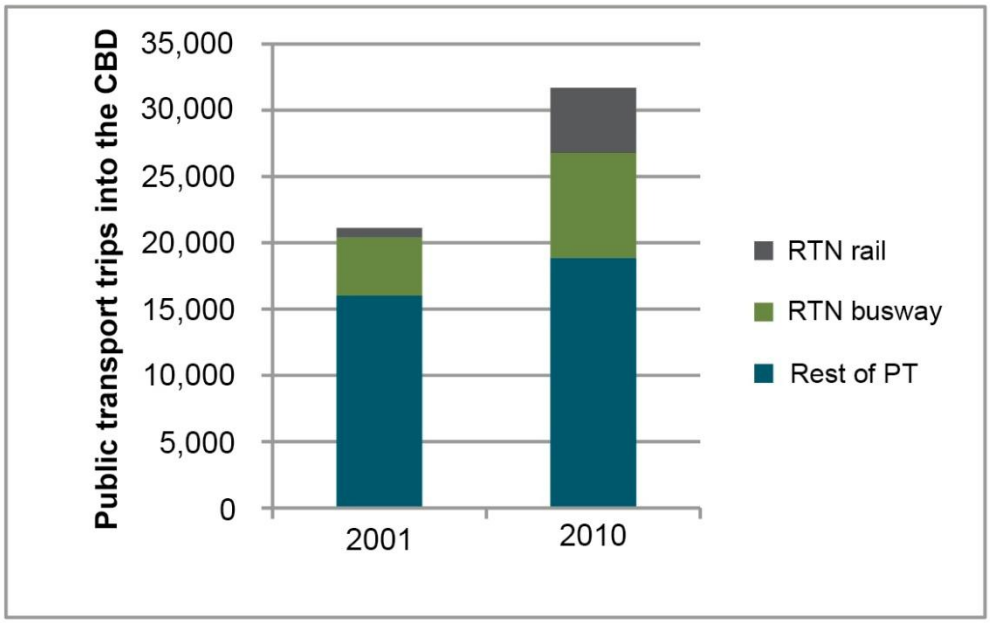
1.1 Context

Public transport trips into the CBD have increased by over 50 percent over the past 10 years, with growth in rail patronage accounting for 40 percent of the increase. There has also been an approximate 15 percent decline in car trips into the CBD in the past decade.

These trends have resulted in a 48 percent CBD morning peak modal share for public transport compared with 52 percent for cars (Auckland Regional Council cordon count 2010).

The growth in public transport use can be attributed to a range of factors but it seems clear that much of the growth in trips has come from the Rapid Transit Network (RTN) which is comprised of the Northern Busway and the rail network. The significant investment in these RTN elements has been key. The Busway has accounted for 33 percent of new trips, while rail has accounted for 40 percent, with the remainder coming from other bus and ferry operations. Figure 3 compares the key sources of public transport trips into the CBD between 2001 and 2010.

Figure 3: Increase in public transport trips by type (morning peak)



Annual rail patronage growth has been strong since the opening of Britomart in 2003, although this has occurred from a low base. Annual trips across the network reached 9.2 million for the 12 months to the end of February 2011, nearly four times the 2.5 million trips on the network in 2003.

Growth in morning peak rail patronage has also been strong. In 2010, morning peak patronage was around 9,500, which is more than two and a half times the figure of 3,751, in 2003.

Investment to electrify and upgrade the rail network is expected to have a significant effect on patronage. The modelling forecasts used as a base case for this review suggest annual patronage of 21 million in 2016 (or 19,000 trips in the morning peak) without the CCRL. Meeting these modelled forecasts will require a doubling of patronage from 2010 levels, which may be challenging despite the benefits of electrification.

Much of the future patronage growth forecast for the rail network comes from areas where significant intensified residential land use in growth nodes has been assumed in the model. Future rail patronage growth, including from the electrified do minimum, is therefore likely to rely, in part, on the realization of these land use assumptions.

1.2 Forecast patronage growth as a result of the CCRL

1.2.1 Business Case approach

The Business Case used two approaches to estimate patronage effects and transport benefits resulting from the project. Two 'strategic scenarios', which did not use modelling inputs, were compared to form the basis for the trip estimates used in the report.

Using the strategic scenarios approach, the Business Case estimated that there would be an additional 48,000 morning peak trips into the CBD in 2041 and that the CCRL would provide for 17,000 (35 percent) of these trips.

The Business Case used Auckland Public Transport (APT) model outputs as a basis for its economic evaluation. Inputs to the APT modelling, such as land use assumptions and project assumptions, were generally consistent with the 2010 Auckland Regional Land Transport Strategy (ARLTS). However, two adjustments were made where 2010 ARLTS assumptions were considered unrealistic by the Business Case consultants. Higher congestion inputs were used, consistent with results for modelling of the 2005 ARLTS, and a higher CBD parking change of $30 per day (in 2006 values) was applied to reflect the scarcity of parking in an intensely developed CBD.

The APT model does not reflect the impact of capacity constraints on rail or other modes. To address this issue, the Business Case assumed that all rail patronage growth ceased in 2024 in the do minimum scenario. This was based on the expected effect of constraints on rail services imposed by the configuration of the Britomart station, and the limited walking catchment of Britomart on the northern periphery of the CBD.

1.2.2 Review approach

Having assessed the assumptions in the Business Case, all agencies involved in the Review agreed to use a revised set of input assumptions consistent with the 2010 ARLTS, as a base case for transport modelling of the do minimum and the project. The key changes were to use parking change (at $16 per day in 2006 values) and congestion assumptions from the modelling of the 2010 ARLTS.

While central government agencies have concerns over several aspects of the 2010 ARLTS, assumptions from this strategy were used to ensure consistency with other appraisals and overall regional policy. On balance, central government agencies

conclude that the assumptions in the 2010 ARLTS, particularly the land use assumptions, are beneficial to the project.

A range of sensitivity tests, including the Business Case's higher congestion and parking charges assumptions, were also agreed.

1.2.3 Review assessment of capacity constraints

Rail capacity constraints reflect a combination of train carrying capacity, passengers' willingness to board trains at different crowding levels, network limits on the frequency of train services and the handling capacity at key stations (largely Britomart).

As noted, the model does not allow for the effect of capacity constraints, so these need to be assessed separately. To address this issue, the modelled forecast peak hour demand for the electrified do minimum scenario was compared to the capacity provided by new electric rolling stock on each of the three lines[6]. To ensure consistency with the Business Case, an all EMU fleet was assumed. Capacity was assumed to be reached when forecast demand exceeded a seated to standing ratio of 1:0.7 or required a standing time of longer than 20 minutes[7].

This analysis showed that standing times became an issue for some services on the Western Line from 2016 onwards and total capacity targets are likely to be exceeded in 2026. On the Southern Line, standing times become an issue from 2021 although the overall standing capacity target is not likely to be exceeded until about 2041[8]. The combined impact of these constraints was estimated to result in the loss of approximately 3,000 rail trips (to other modes, deferred trips etc) in the morning peak in 2041 for the do minimum scenario. This is 10 percent of the total morning peak rail network trips forecast in 2041.

Table 4: Potential reduction in AM peak rail network passenger numbers as a result of capacity constraint

	2016	2031	2041
Western Line	256	847	1,240
Southern Line	0	982	1,911
Eastern Line	0	0	0
Total	**256**	**1,829**	**3,151**

These figures are sensitive to assumptions. The 1:0.7 ratio is less than ratios on mature Asian and European metro rail systems[9] but at this stage there is no evidence for what might be an appropriate ratio in Auckland. In practice, the impact of actual capacity constraints will depend on passenger willingness to accept higher loadings or longer standing times[10]. Passengers may be more or less willing to accept the standing time and loading ratios used in the analysis. However, this analysis does indicate that, while the rail constraints will result in potential patronage loss, rail patronage will still grow by an additional 5,000 trips in the morning peak between 2024 and 2041 across the network.

[6] An all EMU fleet was assumed in the Business Case as part of the do minimum.
[7] This is the ratio agreed with the former Auckland Regional Transport Authority in 2010 as a basis for high level design assumptions for the new EMU fleet.
[8] For the Southern Line with the CCRL, there is also overcrowding to a slightly greater extent until service frequencies are increased in 2031. No capacity constraints were identified on the Eastern Line.
[9] Although these systems may use different seating configurations within trains.
[10] For example if passengers on the Western Line were prepared to accept a standing time of 22 minutes instead of the target 20 minutes, then the potential trip loss in 2041 would decrease from 1,240 to 870 passengers.

1.2.4 Review patronage findings

The impact of the project in increasing rail patronage and reducing bus passenger and car person trips is outlined below in Table 5. These figures come from the APT model using base case input, and have been adjusted to take account of capacity constraints.

Table 5: Impacts of the CCRL (from APT modelling, allowing for capacity constraints)

	Passenger trips into the CBD in 2041 morning peak	Passenger trips on the wider network in 2041 morning peak
Rail Passenger trips in do minimum	11,378	28,149
Rail passenger trips with CCRL	17,390	37,700
Increase in passenger trips due to CCRL	6,012	9,551
Reduction in bus passenger trips	4,000	5,700
Reduction in car person trips	Up to 2,000	Up to 3,851

The Review also considered the share of forecast trips into the CBD that would be provided by the CCRL. The Business Case, using the scenario approach, estimated there would be 123,000 trips (including walking and cycling trips) into the CBD in the 2041 morning peak period. These figures are significantly higher than the figures derived from the overall ART strategic model, which indicates that around 98,000[11] car person and public transport passenger trips will enter the CBD during the 2041 peak period. Consequently, the Review has used figures from the 2010 ARLTS as these provide a better comparison figure, particularly as consistent input assumptions were being used between the relevant models. ARLTS modelling forecasts an increase of 32,000 car person and public transport passenger trips into the CBD between 2006 and 2041.

The analysis shows that there will be 6,000 additional rail trips into the CBD during the 2041 morning peak as a result of the project. This is a modest 19 percent of the additional 32,000 trips forecast into the CBD. Alternatively, the project accounts for around six percent of the total car and public transport trips forecast into the CBD in 2041. The project would remove approximately 4,000 bus passenger trips (approximately 10 percent of total bus trips) and around 2,000 vehicle person trips (approximately five percent of car trips) into the CBD.

The available modelling data does not provide a sound comparative figure between 2006 and 2041 for bus trips. Nevertheless, the data indicates that, even with the CCRL in place, travel by bus will account for:

- 65 percent of all passenger transport travel into the CBD in 2041
- around half of the increase in travel into the CBD expected up to 2041

Table 6 provides a forecast of morning peak trips into the CBD by mode in 2041. Figures for share of travel into the CBD should be treated as 'order of magnitude' results as they require comparison of figures from different Auckland transport models[12].

[11] This figure seems intuitively low given the predicted increase in employment, but does not include a large number of internal trips from the forecast increase in CBD residents. It also reflects the impact of ARLTS travel demand management (TDM) assumptions, which are expected to reduce car trips into the CBD by 21 percent.

[12] Unfortunately, the APT model only provides figures for public transport modes, so it has been necessary to draw on different data sources.

Table 6: Forecast car person and public transport trips into the CBD in the 2041 morning peak by mode, with and without CCRL

	2006 modelled (from 2010 ARLTS)	2041: Revised Estimates (modelled figures unless stated otherwise)		Source model	Share of public transport trips in 2041	Share of estimated car person and public transport trips in 2041	
Scenario		Without	With		With	Without	With
Rail passengers	Not available	11,378	17,390	APT (adjusted for rail constraint)	29%	12%	18%
Bus passengers	Not available	42,675	38,622	APT	65%	43%	39%
Ferry passengers	Not available	3,612	3,548	APT	6%	4%	4%
Total public transport trips	22,986	57,665	59,560	APT	100%		
Car person	44,014	41,138	39,243	Total minus public transport trips		41%	39%
Total car person and public transport trips	67,000	98,803	98,803	ART3		100%	100%

The 9,551 additional trips on the overall rail network as a result of the CCRL can be compared with the 840,000[13] passenger transport and vehicle person trips forecast, as part of the 2010 ARLTS, for the entire Auckland transport network during the 2041 morning peak.

1.2.5 Patronage forecasts and the reliability of the electrified network

The government and the Auckland region will invest over $2 billion in the current programme of upgrading and electrifying Auckland's rail system. This will provide an expanded and more reliable network, new rolling stock and new and upgraded stations.

KiwiRail has advised that while the current rail network upgrade and electrification will meet the objective of generally reliable 10-minute peak frequencies, there will be issues with operational risks, instability and low resilience that will not be fully mitigated by these projects. These problems will be exacerbated by the proposed addition of a station at Parnell.

Auckland Transport has also highlighted operational risks at key points on the network: around Britomart, Britomart Tunnel, Quay Park Junction, the Newmarket Branch Line, Newmarket Junction, and Wiri Junction. Auckland Transport considers that while the network upgrade and electrification investment will mitigate the potential for these risks to adversely affect wider network reliability, it will not be possible to completely eliminate them.

[13] Analysis Supporting the Preferred Strategic Option: WP19, November 2010, pg 48 and 49.

The patronage modelling in the Review has assumed the inclusion of the Parnell Station to ensure consistency with the ARLTS. However, there are concerns about the operational implications of Parnell Station on the wider network. The operational modelling conducted in early 2010 indicated that, without Parnell Station (which was outside the scope of the upgrade project), the Western and Southern Lines have suitable capacity to absorb delays in the turnaround time at Britomart as well as outer termini. The Eastern Line will be subject to delay from disturbances but the effect is likely to be small. Modelling shows that the inclusion of Parnell Station reduces allowable turnaround times at Britomart by a third (from six to four minutes) and therefore constrains the ability for the network to recover from delays[14].

Current network and station improvements are focused on 10-minute peak frequencies and the new trains will be purpose-built for metro operations, including rapid boarding and disembarking. However, it is also clear that there are several key risks including: actual passenger crowding thresholds and boarding times, and the performance of the network at key points. Much will depend on how effectively the network is operated and the extent to which service timetables mitigate the operational risks associated with the construction of Parnell Station. At this point, with electrification still 2 years away, central government officials consider there is insufficient evidence, and too many unknowns, to assess the level of disruption that may occur on the network as a result of crowding or operational issues, and the extent to which these issues may be resolved by the CCRL.

1.3 Assessment of alternatives

1.3.1 Business Case approach

The Business Case considered alternative options to achieve the transport objectives, aside from the CCRL, but the transport impacts of these were not modelled nor were the costs estimated in all cases. The short list of options was:

- on Surface Bus Route Improvements
- a Central City Bus Tunnel with three stations
- an expanded Britomart Terminus (a third rail track between Newmarket and Britomart)

As a result of the absence of empirical information on costs and benefits, the options were evaluated against the preferred CCRL option using a multi-criteria analysis, with the criteria scored by a group of workshop participants with transport systems expertise.

1.3.2 Review findings

The Review's main conclusion was that the analysis of alternatives did not meet Treasury Business Case guidelines for evaluating significant capital projects that require Crown funding. The guidelines set out an early approach of strategic assessment, investment logic mapping, development of a long list of options, selection of a short list of options and evaluation of the remaining options in terms of their costs and benefits. The lack of a strategic front-end, and of a cost benefit analysis of the short list of options, reflects the origin of the Business Case as a specific request to enable route protection for the CCRL, for which the approach taken may well have been sufficient.

[14] If Auckland decides to proceed with this station, without further network improvements, changes to the service pattern or operating procedures will be needed to preserve overall network reliability.

The absence of properly evaluated options in the Business Case means that it is not possible to conclude that the preferred option represents the best use of scarce resources, regardless of its estimated benefit cost ratio.

As noted, the CCRL will carry 19 percent of the additional motorised journeys into the CBD, while bus services could be expected to carry around half of the additional trips. This raises the question of where bus capacity investment should sit alongside rail capacity investment in improving access to the CBD. It also indicates the need for a more sophisticated, multi-modal programme for ensuring optimised transport capacity into and within the CBD. Both the CCRL tunnel and the other options for solving the CBD transport problem need to be evaluated within this wider context.

Appendix D: Transport benefits

This appendix outlines the assessment of the transport benefits included in the Business Case, and the Review findings in relation to transport benefits. The Review findings use the same set of modelling data presented for the patronage results in Appendix C.

Auckland Council and Auckland Transport have noted that the Review identified and corrected issues with the Business Case. Auckland Council and Auckland Transport presented a new policy case in the final stages of the Review. This position has not been assessed as part of the Review, but is presented in Appendix E.

1.1 Broad context

The economic benefits are initially derived from the Auckland Public Transport (APT) model, which is run to calculate benefits for the Do Minimum (DM) and the project, or Do Something (DS), scenarios during the morning peak period in 2016 and 2041. The impacts of the project are identified by the difference between benefits for the DM and DS in each of the modelled years. Figures for other years are estimated by interpolation or extrapolation.

1.2 The Business Case approach

The APT model results for the Business Case modelling show that the project provides total incremental benefits of $41,000 for a single morning peak period in 2016, which increase to $70,000 for a single morning peak in 2041. These benefits reflect the impact of the Centre City Rail Link (CCRL) in improving accessibility to the CBD, but they do not include the benefits of addressing the capacity constraint. Assuming a base annualisation factor of 840[15] (the figure commonly used in earlier evaluations using APT) these benefits would have a Net Present Value (NPV) of $230 million over the evaluation period.

The Business Case applied a higher annualisation factor to the total public transport benefits from the DS model results to reflect the expected greater use of the rail network in the interpeak and off-peak periods. The annualisation factor for the project was increased from 840 in 2016 to 1,000 in 2041. The annualisation factor for the DM case was maintained at 840 on the assumption that, without the project, growth in interpeak and off-peak rail use would not change. This resulted in an additional $285 million in project benefits, taking the cumulative subtotal to $515 million.

The Business Case assumed that rail capacity constraints would begin in 2024, halting all growth in rail patronage from this year onwards. The economic effect of this constraint assumption was modelled by capping the growth of all benefits out of the APT model, including benefits from other public transport schemes, in 2024. This resulted in $455 million in additional project benefits, taking the cumulative subtotal to $970 million.

The Business Case also applied a factor of 1.33 to all transport benefits to reflect the relief of congestion. This was based on the Business Case assumption that the modelled results did not fully capture the extent to which both car and bus congestion

[15] Annualisation factors are used to translate patronage and benefit outputs from the morning peak period model into annual figures. An annualisation factor of 840 therefore assumes that yearly benefits will be equivalent to 840 peak periods.

would be relieved in the CBD as a result of the project. The factor resulted in an additional $385 million in project benefits, taking the cumulative total to $1,319 million.

In total, the adjustments applied in the Business Case increased the NPV of the benefits from a modelled base of $230 million to $1,319 million (or 570 percent).

1.3 Review of the economic benefits

The review tested the main transport and economic modelling assumptions used in the Business Case. The results are outlined below.

1.3.1 Input Assumptions

As noted in Appendix C, the Review considered the assumptions used in the transport modelling and agreed to an amended set of input assumptions as a base case for modelling the DM and DS. These changes to transport modelling assumptions were made to ensure consistency with the 2010 Auckland Regional Land Transport Strategy (ARLTS). A number of sensitivity tests were also agreed.

The use of 2010 ARLTS congestion and parking charge assumptions resulted in marginal decreases in modelled benefits. Using the base annualisation factor of 840, the NPV of benefits decreased from $230 million to $220 million.

1.3.2 Annualisation factors

The Working Group agreed to apply consistent annualisation factors to both the DM and DS scenarios, although at a higher level than the Business Case to reflect recent increases in interpeak and off-peak rail patronage. The Working Group also agreed to apply different annualisation factors for public transport user and decongestion benefits[16]. The figure of 1,100 was selected for public transport user benefits and 950 for decongestion benefits.

The Review identified a technical issue with the approach used to apply differential annualisation factors in the Business Case economic modelling. The application of the factors to all public transport benefits from the model, rather than incremental benefits from the project, was found to be inappropriate. This approach applies a higher weighting to a much larger pool of benefits than those arising from the project itself and consequently inflated the result by attributing benefits from unrelated projects to the CCRL.

The Review resolved this issue by applying the agreed annualisation factors to the incremental benefits arising from the new model runs. This added $50 million in benefits, taking the cumulative subtotal to $270 million.

1.3.3 Review approach to economic effects of the capacity constraint

As noted, the Business Case assessed the economic effect of the capacity constraints by capping all modelled benefits in the DM scenario, including those from bus projects, from 2024 onwards. However, in the DS scenario, the ‘cap’ was removed and all of the benefits were attributed to the project. This approach overestimated the effect of the capacity constraint[17] and, like the annualisation factors issue, inappropriately applied benefits from other projects to the DS.

[16] This reflects the fact that the levels of congestion necessary to trigger the decongestion benefit in the simplified procedures in the EEM are not always present on the Auckland network (for example during off peak periods).
[17] Appendix C discussed the effects of the capacity constraint.

The Review applied an alternative approach to assessing the economic benefits from resolving the rail capacity constraint, which drew on the assessment, outlined in Appendix C, of the potential patronage losses from the constraint. The Review approach increased the benefits of the CCRL by the proportion of DM passengers assumed to be deterred from using the rail network by the capacity constraint. The benefits from resolving the capacity constraint were assessed as $65 million, taking the cumulative subtotal to $335 million.

1.3.4 Decongestion disbenefits in the do minimum

The Review found significant issues with the Business Case's calculation of decongestion disbenefits in the DM and the application of the 1.33 factor. In particular, the methodology appears to double count decongestion benefits already captured in the base modelling. It also applied this factor to the benefits to existing and new rail users, which are unaffected by CBD congestion.

The Review concluded that an adjustment to reflect the relief of congestion in the CBD, particularly for bus travellers, is warranted. The Business Case consultants undertook new modelling and analysis to produce a new estimate for the effect of CBD congestion. Although there were some issues with this approach, the results were included in the overall analysis, adding $52 million to the benefits and taking the cumulative total to $387 million.

1.4 Final position

Taking into account the changes in the modelling assumptions and post-modelling adjustments, the Review transport benefit estimate is $387 million, compared with $1,319 million estimated for the Business Case. The difference largely reflects the impact of resolving the technical issues with the Business Case economic modelling, which significantly increased the overall benefits, and the change to the final decongestion benefits. Changes to the modelling inputs, which impact equally on the DM and DS, have a relatively small impact. The differences are summarised in Table 7.

Table 7: Comparison between Business Case and Peer Review estimates

Figures are in $million, NPV	**Business Case**		**Review**	
	Additional	Cumulative	Additional	Cumulative
Model outputs (using an 840 annualisation factor on morning benefits)	230	230	220	220
Application of revised annualisation factors	285	515	50	270
Application of capacity constraints	455	970	65	335
Application of additional CBD congestion assumptions	349	1,319	52	387
Total benefits	**1,319**	**1319**	**387**	**387**

1.5 Sensitivity tests undertaken

A range of sensitivity tests[18] were undertaken to reflect uncertainty around some key assumptions and future policies as set out in Table 8 below.

Table 8: Sensitivity Tests

Assumption	Benefits ($ million)
Base line assessment	387
ARLTS 2005 congestion factors and $30 daily parking charge. (This represents the modelled position underlying the Business Case) (test 1)	400
Higher annual growth of public transport benefits (test 2)	420
Construction of Aotea Station only (test 3)	290
Fares increased by 10 percent (test 4)	340
Effects of more rapid growth in early part of period as a result of higher congestion than expected on road network (test 5)	420
ARLTS 2010 congestion factors and enhanced parking charges. This has assumed that these start ramping up above the currently assumed levels in 2022 on the opening of the CCRL and reach the full $30 by 2041 (test 6)	590 of which very approximately 400 million is in respect of the CCRL and the balance to other public transport services

While for most of the sensitivity tests the effects are relatively small, the increase in benefits for sensitivity test 6 (increasing parking charges with the CCRL after 2022) is more substantial. This sensitivity test is intended to reflect an AC decision to seek to increase average real daily parking charges to $30 on the basis that the CCRL will provide a high quality alternative to car travel. The benefits increase substantially because all forms of public transport, particularly bus, would benefit after 2021.

An attempt has been made to separate out the effects of the higher parking charges on the CCRL from the effects on the rest of the network. Although it is difficult to distinguish the two effects, the modelling suggests that this latter element would be substantial. Therefore, this proposal should ideally be considered in a wider context than just for the CCRL. However, the increase in bus trips associated with higher parking charges is likely to magnify expected difficulties with congestion in this mode.

Sensitivity tests were also undertaken to reflect the impact of different appraisal assumptions. The Review has assessed the project using the standard government discount rate of eight percent, and an appraisal period beginning when major investment is required. Auckland Council and Auckland Transport hold the view that lower discount rates and longer appraisal periods should be used for transport projects which deliver their benefits over long periods. The results of the appraisal assumption sensitivity tests are set out in Table 9.

[18] Sensitivity tests 1-3 and, 5 and 6 include an allowance for the effects of capacity constraints and bus decongestion effects where appropriate. Although no information was available to assess this for test 4, this assumed the same level of constraint as for the base which was considered to give a reasonable position, given the other approximations that were made in the testing of this scenario.

Table 9: Alternative Evaluation Scenarios (NPV of direct transport benefits $m)

Discount rate of 8 percent	387
Discount rate of 6 percent	570
Discount rate of 4 percent	850
Evaluation over 30 years of operation	440

1.6 Compliance with the Economic Evaluation Manual (EEM)

Significant parts of the Business Case assessment were not compliant with the procedures outlined in the NZTA's EEM for calculating transport benefits. Most of these issues could not be resolved by the Review in the time available and therefore the Review is also non-compliant. Nevertheless, any future assessment of the project presented to government should comply with recommended procedures in the EEM.

1.7 Auckland Council and Auckland Transport position

As noted, Auckland Council and Auckland Transport have provided a *Position on Transport Related Patronage and Benefits*. This is included in Appendix E.

Central government agencies note that the Auckland Council/Auckland Transport policy case was presented during the final stages of the Review. Central government agencies have not had time, or been provided with the background information, to assess the range of technical issues raised by the position in detail.

Nevertheless, central government agencies note that some of the interventions included in the position — particularly the additional park and ride and reconfiguration of bus routes — could be used to increase the benefits from both the DM and the DS, if included as part of a package. Therefore, it does not seem valid to attribute the increased benefits to the CCRL only, as is apparently being proposed by the Auckland Council/Auckland Transport policy case. This issue, and the practical basis for the changed modelling assumptions which underpin the case, will need to be explored and clarified in any future revision of the Business Case.

Appendix E: Auckland Council/Auckland Transport position on transport related patronage and benefits

The following sets out the Auckland Council and Auckland Transport position on transport related patronage and benefits.

1.1 Auckland's growing transport demands

The roading projects planned for Auckland cannot on their own meet its population growth. Auckland's population is expected to grow to around 2.3 million people by 2051 – an increase of almost one million people from today's population and accounting for around 70 percent of New Zealand's population growth over this period.

This growth will increase travel demand for people by around 64 percent. Freight trips are expected to more than double. Once work underway to deliver a properly connected motorway and arterial roading network is completed there will be virtually no more designations for major new roads in Auckland's built up urban area, making major new roads much more expensive, environmentally challenging and impacting more on communities.

Rapid transit (rail and busways) benefits both the users of the system, and those that continue to drive. It has the ability to move more people more efficiently than other modes, freeing up our congested motorways and arterials for freight, commercial, and other trips vital to economic development that cannot use public transport.

	Capacity per Hour
A single lane of motorway	2,400 people
Bus lanes	7,500 people
Dedicated busway	12,000 people
Dedicated light rail	12,000 people
Auckland's rail corridors	20,000 – 25,000 people

Up to 2016, the current rail upgrade will enable electrification of the network and achieve 10 minute frequencies on each rail corridor. The electrification business case identified a strategic benefit of electrification is that it enables future expansion of the rail network including the underground City Centre Rail Link (CCRL).

However, without the CCRL the future development of the city centre will be compromised by its constrained transport network making it harder for people, goods and services to get to and around the city centre to do business and access its international economic, education, cultural and tourist opportunities.

- The constraint in the roading network has already occurred with most approaches to the city centre at or near capacity in the peak periods.
- The bus network is already under pressure with significant constraints occurring from 2014 along Symonds Street and from 2016 along Albert Street.
- The constraint in the rail network occurs in 2016.

As these constraints come into play and become more severe, the city centre will suffer in economic terms and without a clear commitment to resolve these constraints with the CCRL, investment in the city centre will be deferred.

Auckland's rapid transit future includes both rail and buses doing what they are most efficient at doing and constraints in the network will require both bus and rail solutions. Rail is better than buses at addressing traffic congestion in the Auckland isthmus congested transport corridors because the established rail corridors provide separate rights of way unaffected by road congestion and have significant spare capacity once the Britomart constraint is released. Furthermore, initial indications are that the Auckland Plan envisages land use development being concentrated around stations.

The bulk of the Central City is not within walking distance of current stations

The bulk of the Central City will be within walking distance of current stations once the Central City link is constructed

Beyond 2016 the key rail extension is the CCRL tunnel which has three main benefits that will unleash the economic potential and productivity of the city centre – the country's single largest concentration of economic activity.

a) Providing three additional city centre stations creating excellent direct rail access to city centre commercial, employment, shopping, tourist and cultural activities unaffected by road congestion.

b) Removing the constraint at Britomart rail terminus allows dramatically improved train frequencies on the whole rail system.

c) Facilitating the agglomeration benefits of concentrated economic development in the city centre which has benefits for the national economy. This requires a high quality rapid transit service that is not only unaffected by road congestion, but also improves freight and commuter times for those that continue to drive.

1.2 The Auckland Council/Auckland Transport option case

Auckland Council/Auckland Transport believe that the Review of the Business case identified and corrected technical issues with the calculation of transport benefits set out in the APB&B Business Case. Auckland Council/Auckland Transport also believe that the base case accurately reflects assumptions based on some past trends and that the base case represents a lower bound for the estimates of future patronage and transport benefits that would be generated by the CCRL.

However, Auckland Council/Auckland Transport do not believe the base case represents a true estimate of the likely patronage potential and transport benefits of the CCRL and have identified some important policy aspects that need to be taken into account. Auckland Council/Auckland Transport believe that these establish an upper estimate of future patronage and benefits of the CCRL and have identified a policy case comprising the following.

- Improved bus feeder services – a review of the modelling undertaken during the Business Case identified that while improvements to bus feeders was made, there was considerable scope to further improve these given the circa $2 billion investment in the CCRL, and these would result in additional rail trips to the city centre.
- Improved park and ride – a key policy will be the opportunity to improve park and ride opportunities at rail stations, to support the $2 billion investment in the CCRL.
- We have re-examined the extensive work that was done in relation to the rail Mode Specific Constant (MSC) during the development of the APT model. This concluded, inter alia, that the rail MSC would fall by three minutes when the rail timetable was extended to cover evenings and weekends, by a further 1.5 minutes with refurbished rolling stock and a further 1.5 minutes with new rolling stock. This is based on extensive experience elsewhere, including the introduction of new rolling stock in Perth. The CCRL will improve reliability, frequency and also extend the penetration of rail in the CBD and these factors will lead to a further change in MSC. In the light of the earlier work this change was set at four minutes.
- Increased CBD parking costs to $30 per day by 2041 in real terms. This was an agreed sensitivity test undertaken in the Review and, given the significant investment in the CCRL, is an important policy instrument at the disposal of Auckland Council/Auckland Transport (which could also reflect some form of future road pricing). Table 10 shows that the price of parking already is

approaching or above $16 per day on average (assumed in the base case to occur by 2041).

- We have assessed the increased patronage impacts of additional employment that could be generated by the CCRL, particularly around stations where the District Plan and other tools could be used to facilitate increased land uses over and above those assumed in the modelling. Reasons why we believe the CCRL will generate increased employment opportunities include:
  - Greater development density can be achieved as less space is required for parking.
  - There is an assurance over the life of buildings that reliable transport is in place to cope with demands.
  - Major public and private investment will be attracted once the CCRL is in place.
  - As there is no agreement on what this future increase could be, a range of between 5,000 and 20,000 additional employees was assumed.

Table 10: Parking Prices in Auckland CBD Parking Garages (April 2011)

Car park	Cost of all day early bird parking
Mercury lane (ACC)	$8
Downtown (ACC)	$12
Civic (ACC)	$12
Fanshawe St (ACC)	$10
Victoria St (ACC)	$12
Hobson St (Wilsons)	$10
IAG house (Wilsons)	$20
Lower Albert St (Wilsons)	$13
ANZ centre (Wilsons)	$14
Corner Wellesley St/Nelson St/Cook St (Tournament)	$8 Lower level $9 Upper level $10 Under Cover
Graham St (Tournament)	$17
450 Queen Street (Tournament)	$12
Corner Stanley St and Alten Rd (Tournament)	$11
Fort Street, Auckland CBD (Tournament)	$20 (only 20 spaces)
Shortland St (Tournament)	$15
Lumley Centre (Tournament)	$17
City Centre 82 - 84 Albert Street (Tournament)	$13.00 (LG - 4) $12.00 (L5 & 6)
49 Symonds Street (Tournament)	$12.00
Hyatt (Tournament)	$14
St Matthews (Tournament)	$12
Railway Campus – Indoor (Tournament)	$15

Table 11: Forecast Trips into the CBD by Mode; base case results compared with policy case results (Morning peak period: 07:00- 09:00)

Mode	2006		2041: Revised MoT Base Case Estimates (modelled figures unless stated otherwise)		AC/AT Policy case modelled estimates (CCRL in place)	Total Trips @ 20,000 extra City Centre Employees	Total Trips @ 5,000 extra City Centre Employees
	(from 2010 ARLTS modelling)	Observed counts	No CCRL	CCRL in Place			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Rail		4,131	11,378	17,390	23,810	30,983	25,603
Bus		22,251	42,675	38,622	39,639	44,421	40,835
Ferry		3,297	3,612	3,548	4,256	5,058	4,456
Total PT	**22,986**	**29,679**	**57,665**	**59,560**	**67,705**	**80,463**	**70,894**
Car persons (inferred)	44,014		41,138	39,243	31,098	36,958	32,563
Total mechanised	**67,000**		**98,803**	**98,803**	**98,803**	**117,420**	**103,457**
Active			7,338	7,338	7,338	8,721	7,684
Total			**106,141**	**106,141**	**106,141**	**126,141**	**111,141**

In Table 11, columns 1, 3 and 4 are taken directly from the Transport Technical Aspects Review. The following observations can be made.

- Comparing columns (1) and (2) it can be seen that the models underestimated the total 2006 public transport demands into the CBD by 6,600 trips, or 29 percent.
- Comparing the central government agencies base case with the CCRL in place (column (4)) with the Auckland Council/Auckland Transport policy case (Column 5)), 6,400 additional rail passengers are estimated to use the CCRL, representing 12,400 more rail passengers than if there was no rail tunnel (column (3)). This would remove around 10,000 car trips from the city centre each peak period. The underestimate of public transport patronage into the city centre in 2006 by the model, indicates that the patronage uptake (and transport benefits) identified in the policy case could also be significantly underestimated.
- When considering the possible impacts of additional patronage resulting from increased employment resulting from the provision of the CCRL shown in columns (6) and (7), it can be seen that the CCRL could attract up to between 25,600 passengers and 31,000 passengers, depending on the level of additional employment.

Table 11 also shows that of the public transport demands, bus remains the most significant and this makes it clear that the CCRL cannot be considered in isolation of a wider and more cost effective set of solutions to deal with the whole of the transport demand faced by the city centre over the next 20 to 30 years. In this regard, the opportunity offered by the CCRL to increase its role in meeting future demands has not been fully optimised, because even at eight trains per hour (tph) on each of the four of the routes, the CCRL has spare capacity to run more services (up to 30 tph in each direction). Therefore additional services could be added to respond to peak demands and to enable further rationalisation of bus services to the city centre. As well as providing bus operating cost savings, it would free up city centre street capacity for bus service growth from areas not served by rail.

While the number of trains operating into Britomart without the CCRL in place will not increase after electrification, the station will be operating at close to its train capacity. Moreover it is expected that patronage will continue to increase after electrification from organic growth, i.e. the trains will get progressively fuller going into Britomart – particularly if accelerated bus feeder services, fuel prices continue increasing or more aggressive park and ride policies are pursued. Having more people boarding and alighting from trains at Britomart is likely to stress the station facilities (pedestrian access/ egress/ concourse areas) thus increasing the likelihood of service reliability issues arising from longer train turnaround times and other incidents. Given that the timetable is completely Britomart centric, delays to trains at or near Britomart often cause knock-on delays across the network. These reliability issues at Britomart will manifest themselves as disbenefits to passengers and it has been established that unpredictable delays have a particularly high value of time for passengers compared to that for in-vehicle time.

The impact that the Auckland Council/Auckland Transport policy case would have on transport benefits estimated using the revised and corrected methodology developed by central government agencies is shown in Table 12.

Table 12: Overall result - Transport Benefits

	Business Case ($m)		**Review – base case ($m)**		**AC/AT policy case ($m)**	
	Additional	**Cumulative**	**Additional**	**Cumulative**	**Additional**	**Cumulative**
Model outputs (using an 840 annualisation factor on AM benefits)	230	230	220	220	548	548
Application of revised annualisation factors	285	515	50	270	112	660
Application of capacity constraints	455	970	65	335	203	863
Application of CBD congestion assumptions	349	1,319	52	387	94	957
Extra CBD employment - low					62	1,019
Extra CBD employment - high					249	1,206
Benefits from reduced unreliability as a result of overcrowding					173	
Total benefits	**1,319**	**1,319**	**387**	**387**		**1,192 / 1,379**

1.3 Conclusion

The Review of the Business Case has identified some issues with the Business Case calculation of transport benefits and corrected these. The Review base case in our view represents a lower bound to the transport patronage and benefits. The Policy case in our view represents an upper bound.

Auckland Council/Auckland Transport have calculated that the expected rail trips as a result of the CCRL in 2041 are between 23,800 and 31,000 compared to the 17,400 in the Review base case and the transport benefits of the CCRL are between $1.2 billion and $1.4 billion compared to the $387 million in the central government agencies base case.

The key reasons for these differences are:

- improved bus/rail feeder services
- wider park and ride provision
- increased real city centre parking prices by 2041
- improving the ability of the model to reflect the significant enhancement to the electrified rail network enabled by the CCRL by adjusting the mode constant
- capturing the patronage impacts of additional city centre development enabled by the CCRL

There are four important conclusions to be made.

- The policy case shows clear evidence that the CCRL significantly benefits both users of the service and those that continue to drive and is a worthwhile transport project to meet the future growth needs of the city centre.
- The electrification business case identified that a strategic benefit of electrification was that it allowed the expansion of the network through construction of the underground CCRL. By removing the capacity constraint at Britomart, together with the cheaper per kilometre operational cost of electric trains compared to diesels, means that the CCRL enables the rail network to be extended further. The additional patronage opportunities as well as the benefits and costs of any future extensions are not included in these figures.
- There are significant risks to the project of commercial development occurring on the route which would add significant costs, delay the timing of the project or preclude it from ever occurring in its current agreed form for the foreseeable future. Because of this, the route should be protected immediately.
- The wide difference between the policy and base cases clearly shows that the APB&B Business Case does not provide a robust case for government funding in terms of the Treasury's Better Business Case guidelines and Capital Asset Management Framework. These guidelines were still being finalised at the time the APB&B Business Case was being completed. Any application for government funding would need to follow these guidelines.

Appendix F: Employment projections and wider economic benefits

1.1 Context

Identifying and quantifying employment change and wider economic benefits (WEBs) which result from transport infrastructure projects is challenging, and is a developing area internationally. Nevertheless, a formalised methodology for estimating these benefits is necessary to enable comparisons between projects and to ensure that claimed benefits are robust and are based on evidence and parameters specific to New Zealand.

At present, the NZ Transport Agency's (NZTA) Economic Evaluation Manual (EEM) provides for the appraisal of agglomeration benefits in project assessments. Agglomeration benefits are essentially the benefits to firms from increases in effective employment density.

Agglomeration is not the only potential form of WEB that has been identified in the literature. The NZTA is currently completing a research programme to identify best practice methodologies and New Zealand-specific evidence for calculating a broader range of WEBs. The findings from the research programme provide support for extensions to WEBs methodology, based on the United Kingdom Department for Transport's approach, to incorporate additional benefit categories including:

- imperfect competition effects: allowing for the existence of a mark-up between the gross labour cost/time saving and the market value to a business of what is produced in an hour
- labour supply effects: in an imperfect market, improvements in transport could encourage a net increase in the number of individuals that seek and find work
- job relocation effects: where firms shift location to more productive locations (eg the CBD) there is an externality benefit, the 'tax wedge', for each job that relocates
- increased competition effects

Benefits from imperfect competition, labour supply and job relocation have been considered in the Review of the City Centre Rail Link (CCRL). Increased competition effects were not calculated due to methodology and data issues.

1.2 The Review approach

The Review commissioned Steer Davis Gleave UK (SDG) to peer review the Business Case and advise on the additional WEBs from the CCRL. SDG undertook the NZTA's research programme on additional WEBs and developed the draft methodology, so were well placed to inform the Review on best practice.

1.3 Agglomeration benefits

The Business Case estimated agglomeration benefits at $185 million.

SDG's peer review identified a number of issues with the methodology used in the Business Case, and at the request of the Working Group, revisions were made by the Business Case consultants. The methodology used to calculate agglomeration

benefits in the Business Case was based on a "pseudo-conventional benefit" factor, which was originally set at 14 percent of the conventional transport benefits, and was subsequently revised to 33 percent in response to SDG comment. Central government officials had significant reservations with the methodology, particularly as the rationale for the approach was unclear and the methodology inconsistent with the EEM. However, it was adopted by default as the issues were identified late in the process and there was insufficient time to apply the correct methodology.

The Business Case did not include these benefits in the calculation of the urban regeneration benefits (see section 1.5) benefit cost ratio to avoid double counting. SDG advised that, if job relocation is calculated accurately, the two impacts are separate and additive. Therefore the Working Group agreed to add agglomeration to the benefits outlined in section 1.6.

Central government agencies consider agglomeration is, as an upper bound, 33 percent of $387 million (the conventional benefits identified in the Review) or $128 million.

Auckland Council accept the 33 percent figure but consider it needs to be applied against the conventional transport benefits as identified in the Auckland Council/Auckland Transport policy case (see Appendix E). Auckland Council officers further note that the recalculation does not capture reallocation of employment across the region and therefore only partially captures agglomeration benefits.

The Business Case consultants argued that agglomeration benefits would increase to 52 percent of conventional benefits if allowance is made for growth in productivity over time. While this is inconsistent with the EEM, which holds all cost and benefit values constant, the Working Group agreed to include this as a sensitivity test as outlined in Table 13.

Table 13: Sensitivity analysis of agglomeration benefits

Scenario	*Conventional benefits ($m)*	*Agglomeration ($m) at 33%*	*Agglomeration ($m) at 52%*
Central government agencies position	387	128	201
AT / AC low (5,000 additional jobs) employment position	1,192	393	620
AT / AC high (20,000 additional jobs) employment position	1,379	455	717

1.4 Effects on employment relocation

The Business Case proposes that the CCRL will encourage businesses and employees to locate in the CBD where they will be more productive, with positive effects for the wider economy. Auckland Council officers agree with this view but consider that the CCRL's impact will extend beyond the CBD to other centres on the rail network.

1.4.1 Employment projections

In relation to the CBD, the 2010 Auckland Regional Land Transport Strategy (ARLTS) assumes:

- an increase in the residential population of 84,000, from 17,900 in 2006 to 102,000 in 2041
- an increase in full time equivalent jobs of 58,305, from 63,800 in 2006 to 122,105 in 2041

The ARLTS land use inputs are based on the former Auckland Regional Council's Regional Growth Strategy, as embodied in Plan Change Six. Land use categories were manually adjusted on a zone by zone basis to match the Plan Change 6 desired outcomes for each zone.

Achieving the ARLTS forecasts for CBD employment will require an increased rate of employment growth in the CBD in comparison to past trends. It will also require the CBD to increase its share of overall employment. The available data outlined below in Table 14, shows recent average annual growth rates, for a 9 to 10 year period, of between 1.4 and 1.7 percent, with a peak of around 2.0 percent during the period of strong economic growth between 2000 and 2006.

Table 14: CBD employment trends 1996-2009[19]

Source	1996	2000/ 2001	2006	2009	Average annual growth percentage
Statistics NZ Census (total workforce)	50,907	50,823	60,075		1.7
Price Waterhouse Coopers Waterfront Study (Full Time Equivalents)		82,677		93,566	1.4
Business Case, Appendix K (total employment)		71,170		81,200	1.5
Auckland City Council (employment)		80,059	90,600		2.1

The ARLTS forecasts for the CBD require an average annual growth rate of 1.9 percent per annum (pa). This compares to a forecast growth rate of 1.5 percent pa for regional employment to 2041, and therefore requires the CBD to increase its share of employment from 12.3 percent (using ARLTS figures) to 14.1 percent. The ARLTS figures for the CBD can also be compared to a forecast by the former Auckland City Council. Their medium forecast predicted employment growth of 53,200 (from 90,600 in 2006 to 143,800 in 2041) which requires an average annual growth rate of 1.3 percent.

The ARLTS figures for CBD employment growth seem slightly ambitious in light of recent trends. However, they were used in the Review for modelling transport and WEBs to ensure consistency with other project appraisal and regional planning. The Review's key conclusion is that assumptions for additional CBD employment growth beyond the ARLTS forecasts require rates of growth that become increasingly

[19] There are significant differences in employment estimates for the CBD depending on the source. The Review has not attempted to resolve these differences, but they are likely to be explained, in part, by different employment definitions and survey areas.

challenging in light of recent trends and forecasts for employment growth in the CBD and across Auckland.

1.4.2 Employment location change as a result of the CCRL

Employment and location decisions (by businesses) depend on a range of factors of which travel costs including time is just one[20]. There is no established and widely accepted method either in New Zealand or internationally for estimating job relocation impacts from transport projects. Auckland Council officers consider the link between infrastructure investment and employment relocation is well understood conceptually, but has not been properly evaluated within the Business Case.

The Business Case estimated that the CCRL would result in an additional 22,000 jobs in the Auckland CBD above the ARLTS forecasts. This figure was calculated using the ARLTS employment forecast as a base and adjusting the Auckland City Council medium forecast so that the forecast increase in employment started earlier. The additional jobs estimate was informed by United States of America case studies that were selected for their comparability to Auckland.

The Business Case estimate would require an average annual increase in CBD employment of 2.3 percent.

Auckland Council officers reviewed the employment assumptions and had the following concerns.

- The projections use different measures of employment and therefore, cannot be accurately compared.
- The projections relate to different geographic areas, which do not appear to be adjusted for, potentially removing a large share of the apparent impact of the rail project.
- The projections do not appear to have been normalised[21] as claimed in the Business Case.

SDG reviewed the basis for the estimate and recommended that:

"…unless further supporting evidence of the relevance of the case studies and the use and modification of the employment projections can be made available, that the employment impacts are based on unmodified and recognised forecasts."

The Review concluded that there were flaws with the Business Case approach taken to estimate additional jobs directly attributable to the CCRL. The Working Group then considered different assumptions or methodologies that could be used for estimating job growth.

1.4.3 Alternative approaches for estimating employment change

While there is no widely accepted approach to identifying the employment effects of a project, one recognised method is to run an integrated transport and land use model. These models are designed to show the effects of a range of variables, including transport projects, on land use, and vice versa. Auckland's integrated transport and land use model was run to estimate the employment effect of the CCRL. The model output indicated that the CCRL would result in an increase in the rate of jobs locating

[20] See for example – Cole (2005) 'Location criteria – the position of transport.' in *Applied Transport Economics – Policy, Management and Decision Making* (pp.421-426).
[21] This means that the projections have been adjusted using an index as a means of comparison to account for differences in bases and areas.

in the CBD for a period after construction, although this trend eventually reverses. The net impact of the tunnel is an additional 41 jobs located in the CBD in 2041.

Auckland Council and Auckland Transport expressed reservations about use of the model, noting that the effects of employment of even very large transport projects are dominated by other factors such as changes in employment type and available area for development. This is in part due to the model structure and the fact that the region is generally reasonably well connected, particularly by roads.

After reviewing the Business Case and the literature, including the integrated model run, central government agencies consider that the international evidence shows there are examples of rail projects supporting employment location in CBD areas. However, there is little or no evidence to show that there will be significant new Auckland CBD job growth over and above the level estimated in the ARLTS.

Improvements in accessibility provided by the project could nevertheless enable businesses and employees to locate in the CBD rather than elsewhere in the region. Consequently, the upper bound[22] level of job relocation into the CBD occurring directly as a result of the project is likely to be in the vicinity of the morning peak patronage, or around 5,000 of the 58,000 jobs forecast by the 2010 ARLTS. This is significantly in excess of the model forecast results.

Auckland Council officers consider that the project is likely to result in significant additional jobs above the ARLTS forecasts. Given the absence of a robust methodology for estimating additional jobs, the Auckland Council /Auckland Transport policy case presented a low growth (5,000 jobs) and a high growth (20,000 jobs) scenario.

Given the absence of empirical evidence for job growth, the Working Group agreed to identify the potential job relocation benefits for a range of potential scenarios of job growth (5,000-20,000 jobs) as sensitivity tests.

1.5 Urban regeneration benefits in the Business Case

The Business Case calculated WEBs (called urban regeneration benefits in the Business Case) by applying the estimated productivity premium for the Auckland CBD of $29,943[23] to each job. When multiplied by the 22,000 additional jobs, the Business Case estimated net urban regeneration benefits of $3,333 million (Net Present Value).

1.5.1 Productivity premium of CBD jobs

Drawing on advice from SDG and an assessment from Auckland Council, the Review considered the productivity premium used in the Business Case and concluded:

- the assessment did not correct for differences in sectoral composition, workforce quality and capital intensity between the CBD and the rest of Auckland City — overestimating the impacts by more than 100 percent
- no allowance for productivity growth is made when projecting the productivity differential over time, which causes an underestimation of about 23 percent
- the assessment fails to take account of workers' perceived cost of taking up jobs in the CBD, which causes an overestimate of 200 percent

[22] A proportion of the additional patronage will be as a result of change from other modes, and will be taken up by non-work trips, for example by students.

[23] Maré (2008) "Labour Productivity in Auckland Firms," *MED Occasional Paper* 08/09, Ministry of Economic Development, Wellington

- the Business Case used the CBD productivity premium compared to Auckland, whereas it should use the CBD productivity premium compared to the rest of Auckland — this would increase the productivity differential

Based on SDG advice, the Review concluded that only the tax take (the 'tax wedge') from the increased productivity would be additional to benefits already implicitly accounted for in the conventional transport benefits. Auckland Council officers think the benefit is more than the tax wedge as outlined in section 1.8.3.

The above Review conclusions were applied in the calculation of job relocation benefits outlined below.

1.6 Calculation of other wider economic benefits

The Working Group agreed to calculate the following WEBs in accordance with SDG's proposed methodology prepared for the NZTA for inclusion in the EEM:

- benefits from imperfect competition
- benefits from increased labour supply
- job relocation benefits

SDG advised that imperfect competition benefits should be calculated as a proportion of the conventional benefits (2.5 percent based on the draft NZTA methodology and model outputs provided), due to the absence of more detailed data. This amounts to an imperfect competition benefit of $10 million.

Labour supply benefits are calculated using the labour supply response to transport model estimates of commuter journey cost savings (i.e. the increase in people working due to improvements in accessibility). Model outputs were only available for 2041, therefore SDG advised that the most appropriate estimate for labour supply is 4.8 percent of conventional transport benefits. This amounts to a labour supply benefit of $19 million.

Job relocation benefits (net productivity benefits) require estimation of change in employment relocation as a result of the project and the productivity differential arising from this change in location. To simplify the assessment, the Review assumed that all job relocation as a result of the project would occur from outside the isthmus into the CBD, which gives the largest productivity increase. SDG estimated the real annual productivity differential (accounting for industry composition and other factors) for the Auckland CBD, in comparison to the rest of New Zealand, to be $20,107. The differential for the Auckland region, outside of the CBD and isthmus, was estimated as $7,091. This gives an annual net impact on productivity from the relocation of a job from the Auckland region area to the CBD of $13,016. The WEBs from job relocation is the tax take of 32 percent on the increased productivity. This amounts to around $4,200 in annual benefit per relocated job.

Using this estimate, the 5,000–20,000 job range agreed as sensitivity tests by the Working Group provides job relocation benefits of $148 million to $591 million. The Review uses $148 million based on the assumption that 5,000 jobs would relocate into the CBD from outside of the isthmus by 2041 as a result of the CCRL.

Table 15: Business Case and Review wider economic benefits

Benefit category	Business Case estimate ($ million)	Central government alternative estimates (calculated by SDG) ($million)
Imperfect competition	Not estimated in Business Case	10
Labour supply	Not estimated in Business Case	19
Net value added from CBD productivity gains	3,333	148
Total wider economic benefits (beyond the EEM)	**3,333**	**177**

1.7 Comparison with international projects

Table 16, provided by SDG, provides a comparison of the WEBs from various urban rail projects as a proportion of conventional transport benefits. Agglomeration benefits for urban rail ranged from 14 percent to 33 percent of conventional transport benefits. Total additional WEBs ranged from 16 to 56 percent.

The only projects for which job relocation benefits have been calculated are London's Crossrail and the two Melbourne projects in the table below (* refers).

Crossrail, a £16 billion project was estimated to result in between 26,000 and 30,000 jobs. Labour supply and job relocation was equivalent to 28 percent of conventional transport benefits. By comparison, the Business Case estimated urban regeneration benefits at 250 percent of conventional transport benefits. The Review, meanwhile, has estimated job relocation WEBs as 38 percent of transport benefits, while total WEBs are 71 percent.

Table 16: Wider economic benefits from other urban rail projects as a percentage of conventional benefits

Type of scheme	Scheme	Agglomeration	Imperfect competition	Labour market	Total additional
Rail	Crossrail, London	24%	4%	28%*	56%
Light Rail	Tees Valley Metro – Line B, North East England	33%	5%	-5%	33%
Light Rail	Cross River Tram, London	29%	1%	3%	33%
Mixed	Melbourne East West Road and Rail package	22%	2%	6%*	30%
Rail	AirTrack, London	26%	2%	1%	29%
Light Rail	Croxley, London	25%	1%	2%	28%
Light Rail	Tees Valley Metro – Line A, North East England	23%	3%	1%	27%
Rail	Cross River Rail, Brisbane	14%	0%	5%	19%
Rail	Melbourne East West Rail package	14%	1%	2%*	16%

1.8 Auckland Council views on Wider Economic Benefits

Auckland Council officers agree with much of the work undertaken as part of the Review of the analysis of WEBs in the Business Case for the CCRL, but have presented alternative views in five key areas.

- CBD employment effects of the CCRL (refer to Appendix F, section 1.4.3).
- Auckland Council / Auckland Transport policy case (refer to Appendix E and Appendix F, section 1.8.4).
- faster regional economic growth as a result of the CCRL.
- Applicability of CGE analysis.
- Use of the tax wedge in estimating benefits from the CBD productivity differential.

This section sets out Auckland Council's views on regional economic growth, CGE analysis and overall WEBs from the project.

1.8.1 Review of faster regional growth from the CCRL

A key issue raised by Auckland Council officers in the Review is that the Business Case does not capture the impacts of faster regional growth and/or an increase in the size of the regional economy. This section outlines the Auckland Council officers' rationale for this view.

Investment in major transport infrastructure drives changes in land use and activity patterns, which generally increases the efficiency of a city's spatial economic

structure. This results in faster economic growth, increasing the size of the regional economy. This effect is discussed in regards to projects of comparable size and significance in the report *Roads of National Significance Economic Assessments Review* prepared by SAHA for the NZTA noting that roads contribute directly to economic growth. The *Additional Waitemata Harbour Crossing Preliminary Business Case* shows that even small increases in the size of the regional economy from transport infrastructure can have significant effects in relation to the benefits of a project. Importantly, the calculation of all other benefits would be applied across a larger base with respect to both the agglomeration and increased productivity effects.

Conventional market analysis does not capture these effects and an increase in the size of the regional economy, in our view, has not been captured in the rail loop business case. We agree with the statements made by several leading economic consultancies (including Infometrics, NZIER[24] and Market Economics) that economic assessment of major transport or other infrastructure need to take into account the likely effects on the size and growth rate of the economy. Otherwise, the effects are likely to be under-stated, because direct transport effects, agglomeration effects and productivity gains will be calculated using estimates of the business sector, labour force and population, which underestimate the likely outcomes.

This is important for major projects such as the CCRL with region-wide benefits, because a significant share of the economic benefit is likely to arise because the economy as a whole benefits (grows faster) from efficiency gains. Conversely, excluding the economy-wide effects will almost certainly act to understate effects (benefits and costs) for the economic evaluation. Where a project is being evaluated using a standard BCR approach, then the BCR is likely to be correspondingly under-stated.

There has been no allowance for the additional benefits and costs associated with the larger economy in the economic assessments for the CCRL, which would appear a significant omission. Therefore, Auckland Council officers believe the BCR is understated.

The following points help to set this in context for the CCRL.

i. The Business Case identified transport benefits of $1.319 billion over 30 years (at an eight percent discount rate), and wider benefits (mainly agglomeration) of $0.184 billion, totalling $1.503 billion.

ii. By 2021 (first year of rail operation) the Auckland economy would be around $71 billion (VA). If the project generated an increase of 0.36 percent in the Auckland economy[25], this would amount to around $1.3 billion in NPV terms (same period, same discount rate, excluding the direct construction impact).

iii. If a component[26] of this economy-wide effect were acknowledged, then it would materially alter the BCR calculation. This is not to equate value added and benefit, but to recognise that relatively small percentage effects across a large economy for an extended time period may be significant in relation to the project, and that some share of such effects does constitute a ‘benefit’.

[24] NZIER, 2011: Reprioritising infrastructure projects, *NZIER Insight 26,* 8 March 2011.
[25] Based on the indicative figure in the AWHC study.
[26] Value added does not equate to benefit, though benefit is a component of value added. The prospect of effects across the economy appears to be one key reason for distinguishing and prioritizing RoNS relative to other projects.

Accordingly, for accurate economic assessment of major projects it is very important to consider:

- whether the project is of such scale that it is likely to affect the size and rate of growth of the (regional) economy overall
- if so, the likely extent of such effect, especially in relation to the more direct effects (transportation, agglomeration, productivity)

1.8.2 Applicability of a computable general equilibrium analysis

Auckland Council officers have proposed using a computable general equilibrium (CGE) model to estimate the regional economic effects and/or estimate employment change as a result of the CCRL in a more robust way. Auckland Council intends to undertake further work on considering running a CGE model

The CGE modelling provides an ability to understand the pervasive nature of major transport infrastructure, and the likely regional growth effects. This is not possible using the integrated transport and land use model because this model does not have dynamic feedback loops to show economy-wide effects.

Intuitively Auckland Council officers would expect that the greater efficiency observed in the transport industry would flow into the productive firms which would result in greater exports and economic growth domestically. This would generate additional profits and salaries, which would induce greater domestic demand.

This is quite critical, because the scale of effects including travel cost benefits, agglomeration benefits, and productivity differentials need to be applied to the appropriate total level of activity within the economy. If the location and sector-specific effects such as agglomeration benefits are applied to sectors which are too small or too large, then the overall results may be distorted.

Three of the main private sector economic consultancies (Infometrics, NZIER, and Market Economics) are also of the view that economy-wide effects are important, and need to be taken into account in project evaluation. CGE provides a mechanism to do this. A major recent study undertaken by Infometrics included considering CGE modelling for the Roads of National Significance (RoNS) and indicated that RoNS were capable of generating considerably greater benefit (+80 percent) than that identified from conventional analysis. It follows that CGE modelling is a relevant alternative tool for assessing major transport projects, especially because it can help identify the effects on the economy as a whole.

1.8.3 Use of the tax wedge

SDG argue that within the productivity differential, only the tax wedge (approximately 32 percent) can be included as a result of income increases. This is due to the perceived costs (to firms and workers) of relocating to the CBD equating to the increase in net income from being located in the CBD, otherwise they would already locate there.

However, this issue needs to be considered within the context of firms relocating, rather than just employment relocation. For SDG's approach to hold true, the following two points must hold true.

1. The firm needs to currently have the ability to locate into the CBD, but choose not to.
2. The market environment to stay constant, and not be altered by any action by others to shift to/expand in the CBD (in other words, the marginal effect on the

first affected firm equals the average effect across all firms, and there will be no consequent impacts from re-location on market conditions).

Auckland Council officers consider it is unlikely that either would hold. Rather, officers would expect individual and cumulative location changes to affect the marketplace. In turn, these changes would be likely to generate other benefits to firms from re-location to the CBD, which are over and above the net changes in transport costs[27]. Therefore, a larger share (than just the tax wedge) should be included as a benefit.

1.8.4 Auckland Council/Auckland Transport views on overall wider economic benefits

As discussed in Appendix E, Auckland Council and Auckland Transport have presented a policy case that sets out their view on transport benefits. WEBs are calculated as a percentage of these benefits and also vary according to job growth assumptions. The table below provides the WEBs estimates for the low (5,000 jobs) and high (20,000 jobs) Auckland Council/Auckland Transport policy case scenarios.

Auckland Council and Auckland Transport officers have also estimated that the project could generate additional regional economic growth. They estimate this could result in up to $1,300 million in additional benefits but note that only a component of this number is additive to other benefits. The impact on the total WEBs on the policy case is shown in the table below.

Table 17: Auckland Council and Auckland Transport estimation of wider economic benefits

Benefit category	Low growth scenario (5,000 jobs) ($M, NPV)	High growth scenario (20,000 jobs) ($M, NPV)
Agglomeration benefits	393	455
Imperfect competition	30	34
Labour supply	57	66
Job relocation	148	591
Total WEBs	**628**	**1,146**
Increase in the size of the regional economy	0-1,300	0-1,300
Total including regional growth	**628-1,928**	**1,146-2,446**

1.9 Summary

The Working Group has reviewed the analysis and estimation of WEBs in the Business Case for the CCRL. The Review concluded that while some WEBs were omitted, overall the Business Case WEBs were significantly overstated.

The Review examined the Business Case estimate of 22,000 additional jobs as a result of the CCRL and concluded there were methodological issues with the Business Case approach. The Review concludes that up to 5,000 jobs could locate into the CBD, within the total forecast by the ARLTS, as a result of the project.

Auckland Council and Auckland Transport officers consider:

- the job growth will be between 5,000 and 20,000 and that these will be jobs additional to the ARLTS forecasts

[27] Auckland Council has provided further detail explaining their argument in their memo of April 4

- that the Business Case and subsequent additional work has only partially captured the potential WEBs because it has not assessed the growth in the regional economy through efficiency gains in Auckland's spatial economic structure

Central government officials have considered the Auckland Council officers' views, in light of best practice, and conclude that there a number of significant issues with the methodology and evidence basis that make it inappropriate to include these benefits in an economic assessment.

The Review re-estimated WEBs for agglomeration, imperfect competition, labour supply and job relocation. The Review found, based on 5,000 jobs, the WEBs were $128 million for agglomeration and $177 million for the WEBs beyond the EEM (see table below).

Table 18: CCRL wider economic benefits

Benefit category	Business Case estimate ($m)	Review estimates($m)
Agglomeration	185 (1)	128
Imperfect competition(5)	Not estimated in Business Case	10(2)
Labour supply(6)	Not estimated in Business Case	19(3)
Productivity gains from job relocation(7)	3,333	148(4)
Total wider economic benefits	4,652	305

Notes:
(1) APB&B excluded agglomeration benefits from the total
(2) 2.5% of conventional benefits
(3) 4.8% of conventional benefits
(4) Based on 5,000 jobs as a result of the project
(5) This benefit category is not included in the current EEM
(6) This benefit category is not included in the current EEM
(7) This benefit category is not included in the current EEM

Appendix G: Net cost/benefit

1.1 Summary

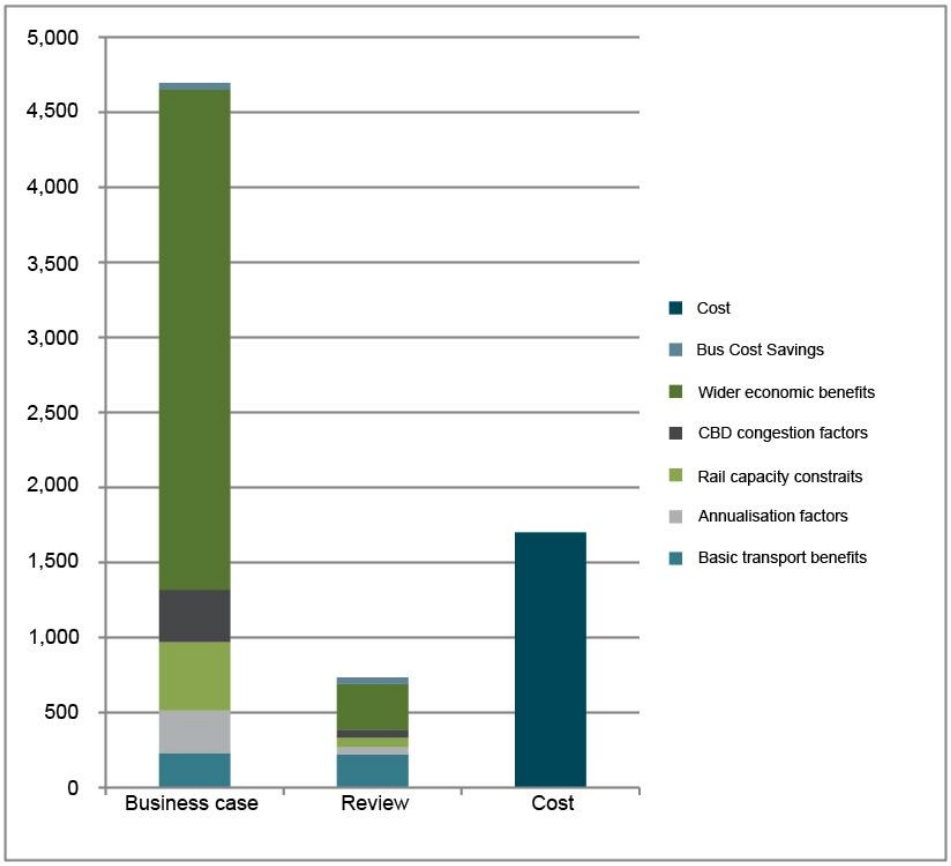
To compare projects and options, the various costs and benefits are identified each year over the modelling period. This stream of costs and benefits is then summed into a single net present value using a discount rate to reflect the “interest effect” where benefits and costs in the future are worth less to someone today (in other words, to be compensated for deferring a payment for a year, interest needs to be paid). The NZ Transport Agency material also sets out another related test, the benefit cost ratio (BCR) which uses the same data as the overall cost benefit analysis but presents it as a ratio which helps to identify relative priorities for projects, especially relevant when funding is tightly constrained.

The Business Case prepared a range of cost benefit and BCR calculations and the methodology was assessed as part of this Review. The Review found that while there were minor irregularities in the approach, they did not have a significant effect on the BCR. The one point identified is the need to use the BCR (National) rather than a BCR (Government), as the latter subtracts revenues from costs with a consequential inflation on the apparent BCR. The table below sets out a summary of the net present values calculated by the Review.

Table 19: Summary of costs and benefits

$ millions NPV, 8% discount rate (real, pre-tax)	Business Case			Review estimates
	DoMin	Tunnel	Net	
Transport Benefits				
Benefits to new and existing users	1,660	2,302	642	214
Decongestion benefits	1,770	2,447	677	173
Bus cost savings				43
Total transport benefits			*1,319*	*430*
Wider Economic Benefits				
Agglomeration benefits			185	*128*
Total benefits as per EEM			*1,504*	
Imperfect competition benefits			-	*10*
Increased labour tax benefits			-	*19*
Productivity benefits			3,333	*148*
Total benefits			***4,652***	***735***
Costs				
Capex tunnel			1,151	1,151
Opex tunnel			36	59
Infrastructure renewals			13	13
Consequent costs			46	60
Capex additional rolling stock			171	171
Opex additional rolling stock			66	104
Net property acquisition			141	141
Bus cost savings			-43	0
Total costs			***1,580***	***1,699***
Conventional Transport BCR			0.8	*0.25*
BCR incl. wider economic benefits			*2.9*	*0.43*
Revenue			237	

Figure 4: Central Government officials' estimates for the overall costs and benefits of the rail tunnel



1.2 Sensitivities

A range of factors have been identified where either there is significant uncertainty, or where even relatively small changes could contribute to large responses/shifts in costs and benefits. Their impacts are summarised in the table below.

Table 20: Key sensitivities

	Net Present Value ($m)	**Benefit cost ratio**
Review assessment (incl WEBs)	-$964	0.43
Key sensitivities	**Change**	
WEBs up by 100 percent	200	0.61
Construction costs increase by 30 percent	-$459	0.18
S1: 2005 congestion factors and $30 parking charge	-55	0.45
S2: Higher annualisation for public transport benefits	-10	0.48
S3: Construction of Aotea station only	-140	0.39
S4: Fares increased by 10 percent	-90	0.42
S5: More rapid rail patronage growth, earlier	-10	0.48
S6: ARLTS 2010 congestion factors and higher parking charges	170	0.59

Appendix H: Timing and what can be done to reduce future uncertainties

Construction of the proposed tunnels and stations was estimated in the Business Case to take around 6 years, following up to 4 years of preparatory work.

The Business Case proposed that bringing the project forward so that it is built by 2021 would enable Auckland to capitalise on the advantages it brings in terms of:

- providing alternative, complementary infrastructure to roads and relieving congestion
- opening up existing capacity in the rail network and providing for ongoing development of the bus network
- supporting the delivery of the region's land use strategies for densification and urbanisation around key centres

Construction of the City Centre Rail Link (CCRL) by 2021 is also consistent with the 2010 Auckland Regional Land Transport Strategy (ARLTS), which states that the project needs to be progressed with urgency and be operational by 2021.

Building the CCRL by or before 2021 is a priority for Auckland Council and Auckland Transport. The Auckland Transport view on timing is outlined below, followed by the Review's assessment.

1.1 Auckland Council / Auckland Transport view

1.1.1 Rail Service constraints

The key constraint is Britomart's ability to handle peak volumes of trains and passengers. Britomart is constrained by its ability to accept 21 trains per hour, which will be close to being reached later in 2011 when the new 10-minute peak train service on the Western Line comes into operation.

There is some debate around the timing of when the effective passenger volume constraint (as opposed to the train volume constraint) cuts in. At present, 5,019 people[28] alight from 32 trains at Britomart between 7am and 9am on weekday mornings. A rough estimation of future capacity (using six-car EMUs and 21 trains per hour) provides a theoretical train passenger capacity of 27,720.

Owing to the very long lead times for the implementation of the CCRL, there are significant risks around the under or overestimation of patronage and exactly when the passenger capacity constraint kicks in, which in turn creates uncertainty around the time when Britomart itself becomes a significant constraint. Note also that as the peak passenger load point lies outside Britomart for other than the Eastern Line, that other locations such as Newmarket may constrain network operation and capacity in advance of Britomart.

There are options to help address the Britomart capacity constraint such as using pricing to manage demand in order to encourage less time-sensitive users to travel outside of the peak, and the ability to run different train service patterns, such as direct west to south services, that avoid the need to use Britomart altogether.

[28] *Central Area Passenger Transport Survey,* 9 September 2009, Auckland Regional Council Transport and Urban Development Committee.

However, these are measures that will extract some limited additional capacity out of the network rather than ones that will form an enduring solution to the capacity constraint itself.

1.1.2 Bus service constraints

While the Business Case discussed constraints around further development of the bus system in the central city, it did not consider external measures that might address some of the bus system issues in the central city, which might influence the timing of the CCRL. Such factors include:

- the absence, until the end of 2012, of integrated ticketing facilitating multi-modal journeys
- the general absence of timed integration between bus and train services at key interchanges — this integration has been a practice of the Wellington public transport system for many years
- sub-optimal operations of the Britomart bus interchange which reduces its operational performance and does not optimise intermodal connectivity for customers
- the widespread distribution of bus terminal stops throughout the core CBD, making it difficult to transfer between many services
- relatively poor central area circulator services, especially to the fast-growing Wynyard Quarter — although Auckland Transport is planning to make significant progress in this area later in 2011
- conflict between different service groups in the same corridors, such as between northern and western bus services on Albert Street, which reduces the effectiveness of existing bus priority measures

While these issues constitute a significant challenge to optimise bus operation in the central city, their resolution would mostly contribute to a rationalised and more integrated central area bus network, rather than one that would add major new capacity. This is due to the constraints of the existing street network, particularly on the eastern side of the city centre, the limited ability to add significant new bus priority measures across the city centre without unduly compromising its place function, and the need to appropriately balance the needs of all road user groups. Also of note is that the bulk of the central area bus network serves areas without rail, particularly the bulk of the Auckland Isthmus and the whole of the North Shore and the Hibiscus Coast.

Any reduction in bus volumes by improving integration with rail would most likely be taken up by improved service frequencies from other areas.

1.2 The Review position

The government is currently undertaking a $1.1 billion programme to upgrade and electrify the Auckland metro rail network (alongside a further $500 million for new trains expected to be funded by the Auckland Council and NZ Transport Agency (NZTA), and ongoing Auckland Council and NZTA investment in rail stations). This will improve the frequency, speed, reliability and quality of rail services. The former Auckland Regional Transport Authority's Rail Development Plan notes that the investment in electrification will:

- reduce congestion, improving freight travel times and road user journey time reliability
- encourage intensification of development along rail corridors
- increase economic activity and labour productivity in the CBD

The government is keen to see evidence of these results being achieved from its current investment in electrification.

1.2.1 Capacity into the CBD, sequencing and prioritisation

Patronage forecasts, covered in Appendix C, indicate that the majority of demand for access into the CBD will come from bus services. These forecasts suggest that the priority for investment in CBD access should be providing for continued growth of bus patronage (particularly through the Northern Busway), followed by ensuring the success of rail electrification and the CCRL.

In practice, rail and bus modes are complementary and therefore capital and operational investment in these modes needs to be pursued together. This is primarily a matter for Auckland Council, Auckland Transport and the NZTA.

However, central government agencies' view is that a robust and affordable, multimodal investment programme is required to provide an understanding of the entire picture of capacity provision for travel to, and within, the CBD. This needs to occur within the context of Auckland's spatial plan, the City Centre Masterplan and the Waterfront Development Plan. Development of this programme is necessary to clarify how the CCRL sits alongside other priorities for meeting demand for trips into the CBD.

1.2.2 An alternative approach to timing: advantages and disadvantages

Central government agencies' view is that it makes sense for Auckland Council to undertake route protection for the CCRL now and to re-examine funding for construction when progress against at least some of the following has been made.

- Finalisation and implementation of the Auckland spatial plan and City Centre Masterplan to establish achievable growth projections for the CBD and to quantify where the growth projected for the CBD will occur.

- Demonstrating commitment to resolving current and emerging CBD access issues, for example by improving bus operations and addressing capacity issues.

- Development of a robust and achievable multimodal programme for transport in the CBD, which considers a thorough analysis of alternatives and identifies the optimal mix of modes to meet demand.

- Beginning implementation of large scale residential developments along the rail corridor.

- Implementation of additional park and ride sites and changes to bus feeder services where appropriate in terms of overall public transport demand.

The implementation of these measures, combined with increased rail patronage above forecasts and a robust economic case, will provide a strong signal that the conditions are in place to drive the necessary benefits from the project and therefore to reconsider the case for the CCRL.

The key disadvantage of making a later decision is that it will delay the onset of the benefits associated with the project, but this must be weighed against the advantages of delaying the costs. A later decision will also lead to some patronage loss from the rail capacity constraint, although this could be mitigated by alternative

service patterns. However, the number of passengers lost to rail and the associated congestion costs are, on their own, insufficient to justify the costs of project construction now.

1.3 Proceeding with a Notice of Requirement for the route

Central government officials understand that the Business Case consultants have largely prepared the core evidence required to proceed with lodging a Notice of Requirement for the route. The process to achieve designation is expected to take between 2 and 3 years, which suggests a designation could be in place by 2014.

While KiwiRail would most likely be the designating authority, there are precedents for KiwiRail to operate closely with the relevant local authority which undertakes to meet the costs and liabilities involved (for example as in the Oakley to Marsden Point Rail Link, where KiwiRail has an agreement with the Northland Regional Council). If Auckland Council decides to proceed, it would reach agreement with KiwiRail to cover the costs involved both of obtaining the designation (which the Business Case estimated at $5 million per annum) as well as the subsequent property purchase costs (which the Business Case estimates at a gross value in the order of $230 million). More detail on the notice of requirement and property acquisition processes is provided on pages 104 to 107 of the Business Case.

Glossary

The Business Case – the business case prepared by APB&B for the Auckland Regional Transport Authority and KiwiRail

The Working Group – the group of people who made up the review team

The Review – the process undertaken (also refers to the central government agencies position)

The base case – the set of assumptions used in calculating the benefits of the project used in the Review

The policy case – an alternative set of assumptions and resulting benefits prepared by Auckland Council/Auckland Transport

The do minimum – the metro rail network post electrification

The do something – the metro rail network including the CCRL

The CCRL – the project as described in Appendix A, section1.2 Project description