

NZ Transport Agency

Northern Busway Review

Report

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Northern Busway Review

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Northern Busway Review Report

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Northern Busway Map

Fully operational February 2008



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1.0 Introduction

1.1 Purpose

(i) *To review public transport (PT) economic benefits and procedures, including those specified in the EEM.* Develop an overview of current public transport evaluation in NZ and provide a context for the post-implementation review (PIR) of the Northern Busway (NB).

(ii) *Undertake a PIR of the NB in terms of costs, benefits and wider outcomes.* Quantify the range of benefits delivered by the NB using available data and appropriate methodologies.

(iii) *Discuss implications for current NZ PT evaluation procedures.* Determine if any identified benefits from the NB are unaccounted for in current NZ PT evaluation procedures and make recommendations accordingly, taking account of: the wider PT evaluation review, the NB PIR and alternative approaches to cost benefit analysis.

1.2 Project Description

The NB project aims as reported to the Transfund NZ Board in May 2004, were to:

- *“...increase accessibility to public transport*
- *provide an alternative mode of transport between the North Shore and Auckland City*
- *reduce travel times of ...HOVs and bus users along SH1*
- *increase person carrying capacity of harbour bridge*
- *minimise adverse environmental effects of private motor vehicle use*
- *enhance activity in city centres by improving accessibility and capacity”*

The original project concept was developed by the Auckland Regional Council in the early 1980's in response to level of SH1 congestion and the difficulties experienced by bus services travelling between the North Shore and Auckland CBD in peak periods.

The busway, associated works and service changes were implemented over the period July 2005 to February 2008 with subsequent park and ride extensions added in 2009.

As defined in the economic evaluation undertaken in 2004 the NB project comprised of:

- A dedicated busway from Constellation to Onewa, at the time regarded as being potentially available to high occupancy vehicle (HOV) traffic. This currently operates as a two-way, two lane bus only facility between Constellation and Akoranga stations (6.2km) and one-way, one lane inbound facility (2.5km) between Akoranga and south of Onewa Road interchange;
- Improvements at Onewa Interchange to permit dedicated busway operation;
- Associated 'basic' stations, park and ride facilities at Akoranga, Westlake, Sunnynook, Constellation and Albany;
- Extension of the existing HOV lane along Onewa Road;
- Provision of bus-only ramps from SH1 to the Albany station.
- Introduction of Northern Express (Albany to Britomart) services and station feeder services.

The original 2004 evaluation was therefore based on a comparison of modelled 'do-minimum' and 'do-something' demand scenarios. This evaluation primarily considered the effects of the busway in terms of the improved operations arising from new busway infrastructure taking into account the following benefits:

- New bus user benefits
- Congestion relief
- Existing bus user benefits

The NB project (the 'do-something' scenario considered in the review) assumed that the following components would be in place in addition to the future 'do-minimum' scenario:

- The exclusive busway lane.
- The planned 2011 bus rapid transit services on North Shore Busway.
- 'Basic stations' at Akoranga, Westlake, Sunnynook, Constellation and Albany.
- Park and ride facilities.

The costs associated with setting up and operating the new bus rapid transit services, the revenues arising from these and a comprehensive range of potential benefits were all excluded from the original evaluation, in order to be consistent with the project evaluation manual (PEM) and funding rules applying at the time.

Current EEM procedures encourage a wider range of potential benefits to be considered and current funding rules permit a more comprehensive project scope to be tested, for example to include the busway, 'full' station costs, associated facilities and services. Such an integrated 'package approach' to economic evaluation has been tested experimentally in this review.

This review has also tested the effects of increasing the evaluation period and reducing the discount rate on the economic evaluation of the NB project.

It is important to note that this review has been based largely on monitoring information from the early post-implementation period and that no comprehensive revision of future year modelled forecasts has been undertaken.

1.3 Project Structure

This report is structured as follows:

- The PT procedures review (Section 2.0) explains the basis used for PT economic evaluation.
- The NB cost benefit analysis (Section 3.0) describes how the NB benefit cost ratio (BCR) has been derived.
- The BCR is only one component of project assessment and hence (Section 4.0) reviews the wider outcomes associated with NB implementation.
- The conclusions and recommendations from the work are set out in Section 5.0.

Four more detailed annexes have also been developed as follows:

- Annex 1 contains the literature review undertaken of PT benefits and evaluation procedures
- Annex 2 describes the detailed cost benefit analysis undertaken and the experimental cost benefit analysis model.
- Annex 3 describes the patronage and traffic data reviewed.
- Annex 4 contains a post-implementation review of the NB project and has been prepared in 'case-study' format.

2.0 PT Economic Evaluation

2.1 Background

A variety of alternative methods can be used to estimate the economic effects of transport projects, for example based on: changes to land values, regional input-output models or financial business case analysis. Each of these can be appropriate in particular circumstances.

In NZ most economic evaluation is based on transport economics, more correctly termed social cost benefit analysis (or CBA) the development history of which in NZ is as follows:

- In the mid 1970's the former Ministry of Works and Development sought to establish a way of valuing road construction projects.
- In 1982 the Ministry of Works and Development began to use cost benefit analysis to justify major state highway projects.
- In 1986 the National Roads Board published the TR9 economic appraisal manual.
- By 1988, CBA was a requirement for assessing all roading projects administered by the National Roads Board.
- The first Project Evaluation Manual (PEM) was issued in 1991 by Transit NZ to replace TR9. The PEM was a road based procedure, and the calculated BCRs were used to select a BCR threshold (typically 4) above which funding could be awarded.
- In 1997 the Alternatives to Roothing Manual (ATR) was published containing procedures for public transport, rail and water freight services. The procedures within the ATR were to a large extent dependent on the benefits and values contained in the PEM, especially in terms of other modes being analysed in terms of their benefits to road users. The ATR also contained the concept of an efficiency ratio (ER), which represented the ratio of additional benefits to the subsidy required.
- The benefit parameter review in 2002 sought to establish robust NZ values for willingness to pay for travel time, ride smoothness and other factors, to reflect NZ transport user preferences. At this time 'ranking BCRs' were used to allow some adjustments to be made to project prioritisation lists on the basis of other known factors.
- In 2006 a two volume Economic Evaluation Manual (EEM) was released, the larger and more detailed volume 1 being for road evaluation with volume 2 covering other modes, introducing the concept of consumer surplus and replacing the ER with a calculated BCR.
- The main change introduced since 2006 has been the introduction of agglomeration techniques, associated elasticities table and the decision to allow mode-changers to carry over any higher value of travel time associated with their former mode.

The development of CBA for transport evaluation purposes in NZ has tended to occur by incrementally adding 'explicitly allowable' benefits into official procedures on the basis of research evidence and comparison with international practice, for example the acceptance of the highest user value of time to be retained by mode switchers (September 2008).

NZ procedures for the evaluation of PT have developed over a relatively short period (1997-2008). However, a BCR method for PT that is reasonably consistent with international procedures has only been in place since 2006. While travel time values of those transferring from car to bus are now retained at the car level in the EEM travel time calculations there has been limited other development of economic evaluation procedures since 2008.

Current economic evaluations of PT in NZ do not appear to make full use of the potential offered by existing procedures, and there are few examples of consistent and comprehensive evaluation of major PT packages (i.e. combinations of infrastructure, terminals, facilities and services).

Current NZTA research will provide the basis for the introduction of wider economic benefit (WEBS) techniques for the EEM. All other WEB estimates produced for NZ projects (to date) have been part

of sensitivity tests or proposed by others and are not part of the formal NZTA EEM based BCR procedures.

Other recent and ongoing research in the field of PT evaluation, for example, the recently published option and non-use value research (NZTA RR 471) and the results from such research work may be incorporated in future adjustments to the EEM.

2.2 Benefits

The 'total economic value' of a transport proposal requires a comprehensive range of potential benefit categories to be considered during economic evaluation. The monetised 'benefits' used in economic evaluation arise (typically) from the cost differences between specified future 'do-something' scenarios and a comparison 'do-minimum' (or 'do-nothing') scenario.

One of the problems with using the discounted net difference in travel time costs (often the primary monetised benefit of transport projects) between the preferred do-something scenario and the do-minimum scenario, is that even when this difference is large, it is possible that (for other reasons) neither scenario may be acceptable when compared with current base year conditions. For example, this could be because both future scenarios are forecast to result in significantly increased congestion or pollution. However, this is one of a number of issues that cannot be addressed solely by cost benefit analysis.

Current PT evaluation practice in NZ typically identifies a narrow range of core benefits that are specific to public transport, most commonly including the following:

- Public transport user travel time savings (for existing passengers and assumed time savings for new passengers)
- Non-user travel time savings (for general traffic) including decongestion benefits.
- Vehicle operating cost savings (for all vehicles, including fuel, maintenance and depreciation costs)

Some types of project may not be overly disadvantaged if economic evaluation is limited to a narrow range of benefits, but it is probable that other project types, such as PT, would be.

A number of other potential benefits are explicitly allowed in the EEM, but are infrequently included in recent NZ PT evaluation practice, including:

- Reliability, frequency and interchange benefits.
- Attribute values (to reflect changes in the availability and quality of facilities and vehicles)
- Savings in the social cost of road crashes.
- Environmental externalities (including CO₂, air pollution, noise)
- Health values (for example, in terms of changes in the level of use of active modes)
- Strategic factors, including agglomeration effects.

It is hoped that the above benefits will increasingly be considered in future evaluations as more understanding is gained of their effects and as PT evaluation is combined with the evaluation of other multi-modal investments.

Advice on how to apply primary benefits is given in the EEM Volume 1 section 2.3 as follows:

Primary benefit	Road	Transport		Walking and cycling	Education, promotion and marketing	Parking and land use	Private sector financing and road tolling
		Demand management	Services				
Travel time cost savings	✓	✓	✓	✓	✓	✓	
Vehicle operating cost savings	✓	✓	✓	✓	✓	✓	
Accident cost savings	✓	✓		✓	✓	✓	
Seal extension benefits	✓						
Driver frustration reduction benefits	✓						
Risk reduction benefits	✓	✓	✓		✓		✓
Vehicle emission reduction benefits	✓					✓	
Other external benefits	✓	✓	✓	✓	✓	✓	✓
Mode change benefits		✓	✓	✓	✓		
Walking and cycling health benefits		✓		✓			
Walking and cycling cost savings		✓		✓	✓		
Transport service user benefits			✓			✓	
Parking user cost savings		✓			✓	✓	
National strategic factors	✓	✓	✓		✓		

The above table could be misinterpreted to imply that certain benefits cannot be awarded to certain project types. For example, to imply that health benefits are not relevant to either PT or road investments would clearly be incorrect. It is important to ensure that benefits (of whatever type) are appropriately selected and correctly applied in each particular case. Economic evaluation also needs to take account of any disbenefits associated with individual projects.

In the case of the NB , which predates the above table, the monetised benefits in the original economic evaluation consisted of: existing user benefits (22%), new user benefits (28%), traffic decongestion (41%), vehicle operating costs (7%), crash reduction (2%) and CO2 (0.3%). The approach taken to this evaluation was quite advanced at the time in a number of respects, although only a limited range of benefits were considered.

It is possible for economic evaluations to include 'additional' monetised benefits that are not discussed in the current EEM, provided that sufficient evidence is available and provided that double counting can be avoided. For example, such additional benefits could include:

- Other identified 'wider economic benefits' such as improvements in productivity, competition, labour supply and job relocation benefits.
- Community and corridor willingness to pay for services in terms of option and non-use values.

Although the EEM is generally permissive and helpfully allows other evidence to be presented in support of applications, the EEM is silent on a number of potential PT benefits, meaning that applicants may need to undertake original survey and research work, thereby discouraging the use of some potentially relevant benefits.

In broad terms, the EEM can be said to cover many potential PT benefits in one way or another, however, two improvements to current practice are needed, namely:

- NZ evaluation practice needs to fully incorporate the potential benefits associated with PT, for example, with respect to improved service reliability and the health benefits of increased walking, contained within the existing EEM.
- Additional PT benefits (such as option and non-use values) need to be incorporated into the EEM as being explicitly allowable and to be supported by appropriate advice.

The procedures within the EEM are intended, firstly to assist in determining whether a project is 'economically worthwhile' in an absolute sense and secondly to permit 'comparisons between projects' to be made so that potential investments can be prioritised on a consistent basis and to assist in the productive allocation of scarce funds.

In some cases, the inclusion of some benefits (for example option and non-use benefits) may also be helpful in identifying differences between investment choices and assist in determining the direction of investment strategy.

Whatever the selected benefit categories for a particular project evaluation are, it is important that their monetised values are as accurate as possible and that these benefits are applied appropriately.

The monetised value of benefits is usually established through research and comparison with international practice. Values are typically updated over time in keeping with published indices, for example, the stated preference (SP) values were updated in the EEM Volume 2 in the January 2009 amendment.

Outline advice on the way benefits are expected to be applied (in terms of recommended CBA methodologies) is also provided in the EEM.

Travel Time Values

In the evaluation of transport projects, travel time savings typically represent a very large proportion of total benefits and so deserve particular attention.

For the NB, there are some particular aspects concerning the application of travel time values that require consideration as follows:

- Users of the busway have high car availability, with up to 50% of new users being former car drivers and even more who have a car available

- The EEM treats existing¹ public transport commuters as having a significantly lower value of time than car drivers. In addition, all car drivers and car passengers have their time values increased in congested conditions. Only those who are standing on PT (a small minority) have their time increased, but even this this remains well short of car time values. The contrast between car and bus is even greater for non-work travel purposes.
- Whilst this approach may be justified for some PT evaluation purposes, a different approach is required in the case of rapid transit system (such as NB) users because of the high service quality and significant mode choice available. In such circumstances it is illogical to assume that NB users have a lower value of time than car users.
- There is a strong case in the case of the NB, for PT user time values to be at least equal to average car (driver and passenger) time values. In other words, the average bus user time value (whether seated or standing) are likely to be at least equivalent to the value of car users.
- The approach of using an equity value of time for all modes is applied within evaluation procedures elsewhere, for example in the UK. This is particularly important to avoid potential distortions when evaluating rapid transit systems (such as the NB) which have a high proportion of car available users.

Other Benefit Values

Vehicle operating costs (VOC) often represent a high proportion of total benefit in current evaluation practice. This raises issues of the effects of potential changes in fuel price over the evaluation period. There is no specific advice within the EEM on this, although some useful NZTA research has been undertaken in this field (see for example: *MRC, Fuels and other Delivered Energy Forms, RLTS Working Report No.05, ARC, 2009*). In the case of the NB, no variation in fuel price over the course of the evaluation period was tested as part of the original economic evaluation or as part of this review.

Safety benefits are sometimes calculated (simplistically) using default crash rate assumptions for different road types and the effect of reduced vehicle kilometres travelled (VKT) on the wider transport system. This was the case for the NB, and the associated safety benefits were not forecast to be large. However it is important to also consider the background safety trends before assuming all forecast changes in safety can be allocated to the project in question.

Travel time savings, VOC and safety benefits (for general traffic) due to traffic reduction effects and/or increased traffic speeds, are often significant elements in PT evaluation. However these are non-user benefits and do not represent 'intrinsic benefits' associated with the use of the PT system itself. In urban conditions non-user benefits may constitute the majority of monetised benefits but may not represent the primary purpose of developing projects such as the NB. The provision of more viable PT travel choice due to higher service speed, quality, frequency and increased peak period service capacity are more likely to represent the real reasons for initiating major PT projects and it is important to reflect these as accurately as possible within economic evaluation.

Other monetised benefits are typically small in current evaluation practice. For example, those relating to environmental externalities may only be a very small proportion of benefits, something that can appear inconsistent with their perceived importance in public and political terms, their official policy status and their potential long term impacts. These problems are partly caused by the limited application of available procedures in current evaluation practice.

¹ The EEM now allows new users who were formerly car drivers to retain their higher value of time when using PT.

If benefits are perceived by the evaluator as small they are often ignored or alternatively nominal values may be adopted to minimise the need for what is sometimes considered ‘time-consuming’ analysis.

Other benefits may be excluded from PT evaluations due to a lack of supporting evidence although this situation is improving. Some potential benefits are emerging from current research, such as wider economic benefits, option/non-use and health benefits all of which can be potentially significant if fully applied to the economic evaluation of PT. These and other potential benefits are at varying stages of research and development and once identified need to be applied consistently.

It is however important that the scale of any potential additional benefits is not overstated and it is possible that additional benefits may not be large when applied as a difference between investment choices, rather than as a measure of the total economic value of investing at all.

Annex A2.1 discusses the potential range of benefits and assumptions considered in this review for NB evaluation purposes, as follows:

- PT User Value of Time (VOT) (used to evaluate the benefits to existing and new PT users)
- Vehicle Operating Costs (VOC)
- Safety
- CO2
- Agglomeration
- Decongestion Benefits and Peak Spreading
- Reliability
- Car User Option Values
- Community Option Values
- Extended Evaluation Period (60 years)
- Reduce Discount rate to 4%
- Health
- PT Fare and Consumer Surplus
- Headway
- Wider Economic Benefits (WEBS)

2.3 Costs and Revenues

Costs

It is important that all capital and operational costs of PT infrastructure, associated facilities and services are included when undertaking economic evaluation.

The cost categories of major PT projects/packages may include the following:

- Capital costs of land, infrastructure, buildings and facilities.
- Maintenance costs.
- Service operational costs.

To allow comparisons between services, standardised capital replacement assumptions should be used to avoid distortions occurring due to historic under-investment. An accurate estimate of cash flow is also needed for business case and for financial (cash flow) analysis purposes.

The pre-implementation project scope and associated cost estimate needs to be recorded at the point of funding approval. In the case of capital elements, this is at the point of ‘construction’ approval.

Cost savings may result from:

- The release of land (in central areas or along transport corridors) that would otherwise have been required for parking.

- Efficiencies realised through ‘urbanisation economies’. (A1.1 ref 18)

When significant changes in cost estimates or scope occur during the course of project development it is then important to recheck the economic evaluation findings. However such ‘updating’ of the BCR is rarely undertaken, even for major projects.

Revenues

It is important that all revenues from fares and other sources (for example, through concessions, rentals and charges) related to the project and associated services are included in economic evaluation.

Fare setting assumptions need to align with project objectives and to take account of the relative pricing of other modes. It is important to note that wider considerations such as fares policy, farebox return requirements and other modal pricing policy (such as the level of car parking charges) will also affect revenue, patronage and associated benefits. These wider policies provide the context for economic evaluation and will therefore have significant effect on any associated BCR results.

Evaluators may experience difficulties in obtaining the revenue, cost and profit information needed to undertake a detailed economic evaluation of PT projects. This commercial sensitivity is particularly high in the case of non-subsidised services, but can also extend to the tendering and monitoring of subsidised services. However, it is usually possible to overcome such difficulties through evaluators entering confidentiality agreements with data holders and ensuring that any results are produced in a suitable format.

The funding gap calculation in the EEM introduces a standardised method to estimate subsidy requirements, although the 12% financial discount rate, used to calculate the funding gap, is unusually high (compared with to the average cost of borrowing, which is probably currently closer to 7%, and so tends to focus unrealistically on short term returns.

The standard NZ approach to PT evaluation is to calculate the ‘government BCR’. This is a calculation method that ‘nets revenue off costs’ in the denominator, with all benefits included in the numerator.

The alternative ‘national BCR’ is based on the ratio of total benefits to total costs and is also required by the EEM, but is often not calculated in current PT evaluation practice.

In some international procedures (such as in the UK), fare revenue is also considered to reflect perceived (and expressed) benefit and therefore included in the numerator (when calculating the government BCR in EEM terms). The view taken in NZ to date has been that adding fare revenue to benefits would represent ‘double-counting’.

Fares revenues can also be regarded as a transfer payment, which are excluded from consideration as economic benefits or costs when calculating the national BCR in EEM terms.

PT service related economics, including the consideration of revenues, has not been included in the primary review within this report (section 3.0 below) to maintain consistency with the original evaluation methodology, to complete a PIR for NZTA purposes. However, service related economics have also been considered in terms of the additional testing undertaken as part of this review, using an experimental PT evaluation model. This testing was undertaken to scope the issues associated with treating the NB as an integrated PT package (Annex A2.5).

2.4 International Practice

It is important that an appropriate range of economic benefits are selected to represent the 'total economic value' of a project and also that suitable values for these benefits are applied within evaluation procedures.

The forecasting and analysis of public transport demand can be derived from multi-modal transport models, from other techniques such as direct demand (regression) or elasticity based methods, each of which have advantages and disadvantages and can therefore be appropriate in different circumstances.

Key determinants of economic evaluation include: the selection of benefits, the detailed method used to calculate the BCR, the discount rate and the evaluation period.

The literature review (Annex 1) contains a range of international material including a review undertaken in 2007 (A1 1) comparing Australian and UK PT evaluation procedures with those in NZ. The review concludes that: *"Generally the existing Land Transport NZ Economic Evaluation Procedures for Public Transport in EEM2 are consistent with recent developments and international practice"*. However the review suggested that the procedures are made: *"...more logical and easy to use and encourage people to take a more mode neutral approach in the formulation of proposals."* and reported from the discussions held with practitioners that *"..several people considered the valuation of time benefits for passenger transport was set too low compared to overseas procedures ..."* It is recommended in the review that: *"A detailed list comparing the benefit parameters given in EEM2 with ATC Nationals Guidelines and Webtag is given In chapter 5. It is suggested that a table of potential benefits of PT initiatives be developed form the list and issued as an amendment to the PT evaluation procedures."* Although this list may require updating, because of its significance and the fact that little of it has yet been implemented, a copy of this table is provided in the Appendix to Annex 1.

Another particularly interesting study (A1 7) evaluated an urban public transport case study in different ways based on the individual economic evaluation procedures from of a range of 12 different countries. The results showed that evaluations from Australia, USA, Germany, the UK and the Netherlands all produced economically viable BCRs in the range 1.0 to 2.61. The NZ procedures produced the second lowest BCR of 0.39. A response from with one of the authors (Currie) explains the method used to establish the validity of the comparisons made in the study as follows: *"Our approach is the only one possible with comparative international studies; first we converted all valuations (costs and benefits) used in different countries to values in same reference year using changes in inflation rates in each country. This puts valuations in 'real' terms. Then we selected an exchange rate for that year and made all values of benefits and costs relative to the same currency. This is entirely open to the problem of variations in value and exchange but that is also true of all dealings between countries. Our paper has now been published in one of the leading international transport journals (citations below) and has been presented at numerous transport forums internationally so has been through the sieve of numerous reviewers ..."* (pers. comm. March 2012). The paper has therefore used a commonly accepted approach, is the work of a leading author in public transport, has been peer reviewed by leading journals and therefore provides a useful example of PT project evaluation performance in comparison to the other countries reviewed.

The concepts of community 'option' and 'non-use' values are not explicitly referred to in NZ economic evaluation procedures, but are included in UK procedures: (A1 10) *"Option values together with the value of consumption form two elements of the Total Economic Value (TEV) of a good. The concept of total economic value has developed in the literature to represent the maximum value of a good to the individual."* This reference considers two particular concepts: namely: *"The option of consuming a good at some point in the future...i.e. the option value (OV)"* and *"The continued existence of a good...non-use values (NUV)"*

Procedures from the USA include a range of potential monetised PT benefits that are not explicitly included in current NZ procedures, for example: motorist option values (of using PT a certain number of times a year), water pollution and savings in car parking land. In addition to agglomeration benefits, the USA procedures also include techniques to evaluate 'urbanisation economies' (associated with reduced infrastructure costs).

Wider economic benefits have also been identified with major PT investments in a number of studies including (A1 12): ...*"In more recent work a doubling of public capital investment has been found to lead to between 5% and 30% increase in productivity (see the review by Quinet and Vickerman 2004) which suggested a sustained 10% increase in public transport investment would have long-term impacts of between 0.7% and 3.7% of GDP."*

An international review of PT (A1 19) concluded that: *"Current appraisal methodology does not capture the full benefits of public transport. Public transport contributes to all aspects of urban life, and consequently transport appraisal needs to consider all of the following areas:*

- *Economic: public expenditure and income, user time savings, reliability and wider economic impacts;*
- *Environmental: noise, air quality, greenhouse gases, landscape, townscape, historic heritage and*
- *water environment;*
- *Social: safety, security, accessibility, mode interchange, land-use policy, physical fitness and*
- *journey ambience."*

A review of travel time values (A1 20) found that:

"Relative to real incomes, the New Zealand PT values of time are in the order of half the level of the values adopted in Australia and UK." and

"In UK, PT values adopted are taken as equal to car driver and passenger values, on equity grounds. In Australia, the PT values are only slightly lower (within 20%) of the car driver and passenger values. In New Zealand, the PT values are in the order of half of the car driver and passenger values".

Another review (A1 22) identifies common errors in comparing PT and car costs and benefits including:

- *"Comparing average rather than marginal costs.*
- *Ignoring parking costs.*
- *Undervaluing safety and health benefits.*
- *Ignoring generated traffic impacts.*
- *Undervaluing congestion reductions."*

2.5 NZ Procedures

Overall Approach

Economic evaluation as represented by the NZTA EEM was originally developed for the purposes of evaluating and comparing road projects. The EEM has been adapted and improved over time in terms of its treatment of other modes, but there remains considerable scope for further improvement in the EEM procedures, particularly in terms of PT.

Current PT evaluation procedures (as contained in Volume 2 of the EEM) are (in comparison to the EEM Volume 1 roading procedures) relatively limited in scope and depth. It should however be noted that Volume 2 has been developed as a companion to Volume 1 and therefore relies on a number of Volume 1 procedures.

The EEM volume 2 is also not easily applicable to the full range of public transport proposals, for example to major urban rapid transit proposals or to inter-regional PT services. It is appreciated that there are relatively few major urban rapid transit proposals and non-urban PT projects in NZ;

however the current difficulty and unsuitability of evaluation procedures for such projects are likely to discourage proposals from emerging.

This criticism of current PT procedures needs to be qualified by the fact the procedures are often permissive and allow the inclusion of evidence of other benefits relating to any particular proposal. Nevertheless, there are limitations on how this evidence can be applied in practice. As a result of funding policy, resource, data constraints or limited understanding, a number of potential benefits within the EEM tend not to be investigated by practitioners as a result of accepted 'evaluation conventions'.

The lack of specific guidance in the EEM means that a large burden of proof is placed on individual proposals (i.e. not only very large PT proposals) if they wish to demonstrate that 'additional' benefits (i.e. not 'explicitly allowable' and described in detail in the EEM) need to be taken into account.

Current procedures are also rarely comprehensively or consistently applied to integrated transport investment 'packages' or to major PT infrastructure projects.

PT evaluation in the EEM is dominated by the need to demonstrate significant mode change and traffic congestion relief. For example, the advice in the EEM V2 SP10: *"(1) Service improvements primarily concern existing peak period services and as a result of improvements commuters change modes from private vehicles to bus or rail. (2) The primary benefits are: travel time savings (including congestion reduction), vehicle operating cost (VOC) savings, accident cost savings, parking and environmental benefits (including CO2 reduction), reliability benefits and vehicle and infrastructure benefits."*

There are a number of other potential inconsistencies about the treatment of benefits potentially relevant to PT in the EEM, for example, at present health benefits are only applied to walking and cycling proposals, although really these should be applied to other proposals, including PT, if changes in walking and cycling activity are forecast.

It is appreciated that a number of PT related advice is contained the EEM Volume 1 and the NZTA Planning Programming and Funding Manual, but the fragmented nature of the current documentation does not encourage comprehensive and consistent evaluation.

Travel Time Procedures

The provision of PT services and associated infrastructure is often dependent (in funding terms) on how effectively PT services are expected to reduce road traffic demand. In terms of the current transport system, this can often be a theoretical, rather than significant impact. This is partly due to the scale of time savings to general traffic, which if small, may not attract 'average' time values and partly because in some cases where more substantial time savings occur, especially in highly congested conditions, these savings are rapidly eroded by induced traffic.

In a more managed system (for example with road pricing or effective traffic management controls in place), the mode transfer resulting in small reductions in traffic level is likely to make a more substantial difference to road network performance. This is especially in terms of reducing the incidence of flow breakdown and of maintaining such improvements into the future. All of this points to a need for more rigorous and robust analysis of PT related congestion relief effects using well-structured and calibrated transport models, as is the case (virtually universally) with major road projects.

The low values of PT user time in the EEM (established through surveys of general PT services in NZ) are inappropriate for the evaluation of modern high quality urban rail services and other rapid transit PT modes, such as the Northern Express (NEX) services along a dedicated busway. Here it should be noted that if more specific and regional values were to be applied, then this may result in higher values of time also being applied to some Auckland roading projects.

There are a number of particular aspects relating to travel time valuation that are problematic, including the dominance of time savings in justifying projects, the potential over-valuation of small time savings (due to the linear valuation methods applied). This is an area of on-going debate and research, for example, there may sometimes be advantages associated with using a constant unit value of time.

There is also doubt over whether or not time savings are ever actually realised (or if the time saved is simply consumed in additional travel).

The valuation of travel time in the NZTA EEM makes a distinction between different travel purposes, namely commuter, non-commuter travel time values and for work in travel (generally for trips made during the working day). There are arguments for higher values of time to be applied to 'work in travel' on public transport, especially on high quality rapid transit services, although the EEM is currently silent on the issue of work undertaken during commuting.

The EEM also defines different travel time values by mode. Some countries, for example the UK, do not apply such a distinction on equity grounds.

For the evaluation of new PT projects in the EEM, travel time values of PT users are used, including consumer surplus and some non-time based benefits, such as comfort and service quality

Future Development of the EEM

There would be a number of advantages if the two volumes of the EEM were combined, integrated and revised in order to encourage:

- More consistent and comprehensive evaluation practice.
- Greater modal co-ordination between and integration of proposals.

The future EEM development could take the following approach:

- More clearly define the purpose and role of economic evaluation within the context of the overall decision-making and evaluation/assessment framework.
- More clearly specify the relationship of economics, including potential overlaps, within the NZTA assessment factors, namely: efficiency, effectiveness and strategic fit.
- Further develop the strategic 'dimension' of the EEM in an economic sense, whilst maintaining a clear separation between the effectiveness and strategic fit assessment 'factors'.
- Review the range of user needs and create an integrated multi-modal economic manual (in a single volume with non-economic material to be referenced as separate support documents)
- Develop a user friendly flow chart based approach to the evaluation manual identifying key relationships, dependencies and conflicts, to act as a guide to appropriate ways of using the manual in particular circumstances.
- The new EEM could still usefully include separate sections, including for PT, to make it as accessible and user friendly as possible.
- For the evaluation of PT of the EEM could usefully be adjusted to:
 - *Increase the range of described (explicitly allowable) PT benefits.*
 - *Equalise values of time between modes.*
 - *Include advice on major urban rapid transit proposals and non-urban PT project evaluation.*
- Design and hold review workshops to test potential changes to procedures.
- Develop interactive software to assist users and to encourage consistency between evaluations. Consider detailed implications of resulting recommendations, in terms of: feasibility, timescales, costs and potential impacts on other procedures

3.0 Northern Busway: Cost Benefit Analysis

3.1 Introduction

Project Scope

Scoping the evaluation of major projects is often problematic, with a number of uncertainties that can affect the appraisal. Often how and where to draw the line on assumptions and methods is difficult and the NB evaluation obtained funding approval in 2004 after previous attempts were abandoned due to a mixture of technical and procedural problems. These earlier attempts were characterised by a more comprehensive evaluation approach that did not align with funding rules at the time.

However, because of the variety of funding sources involved, the types of investment involved and associated funding rules, a more limited evaluation approach was adopted. This considered the NB investment mainly in terms of its value as a limited access (buses and HOVs only) state highway. Some allowance for 'basic stations' was also made in the final 2004 economic valuation.

The original evaluation was based on a comparison of modelled do-minimum and do-something demand scenarios. The 2004 evaluation considered the busway in terms of benefits due to improved operations arising from new infrastructure, as follows:

- New bus user benefits
- Congestion relief
- Existing bus user benefits

The base do-minimum scenario included the following public transport assumptions:

- Planned 2011 public transport services outside the North Shore as per Regional Passenger Transport Plan (2003);
- Current (2004) public transport services;
- The Central Transit Corridor (bus priority between Britomart and Newmarket);
- Fanshawe Street and Albert Street bus priority projects.

The NB project (i.e. the do-something scenario considered in the review) had, in addition to the do-minimum, the following components:

- The exclusive busway lane.
- Planned 2011 bus rapid transit services on North Shore Busway;
- Basic quality stations at Akoranga, Westlake, Sunnynook, Constellation and Albany;
- Park and ride facilities;

The costs associated with setting up and operating the new bus services, and the revenue arising from these, were excluded from the evaluation (as this was said to be consistent with the PEM at the time of the evaluation). The difference in operational costs between the do-minimum and do-something scenarios in the original evaluation was based on changes in VOC as a result of mode change and reduced congestion to general traffic.

Approach Taken To Cost Benefit Analysis By This Review

Cost benefit analysis has been undertaken by this review in order to check the original economic evaluation on the basis of early post-implementation monitoring data (the PIR) which indicates that out-turn benefits were higher than anticipated due to:

- Busway patronage increasing more rapidly than forecast.
- Bus services operating faster and more reliably than prior to the busway
- Reductions in post-implementation peak traffic volumes on the parallel SH1.

Out-turn projects costs were slightly higher than anticipated due to variations identified during project implementation.

In addition to recalculating the original BCR for PIR purposes, additional cost benefit analysis has been undertaken to illustrate the effects of:

- Applying current EEM procedures.
- Incorporating additional benefits.
- Adjustments to evaluation period and discount rate.
- Adjusting the project scope to include services and stations in the evaluation.

Current funding rules would permit a more comprehensive project scope to be tested, for example to include the full costs of the busway infrastructure, stations, associated facilities and services. Such an integrated 'package approach' to economic evaluation is recommended and has been tested experimentally in this review (Annex A2.5).

3.2 Data

The quality of information available is partly dependent on the scale and nature of the project concerned.

It is common for PIRs to experience difficulties obtaining data that accurately quantify changes between pre and post-implementation conditions. This is primarily because there are no requirements for projects to gather appropriate monitoring data for the purposes of post-implementation review.

However, in general the larger the project, the more comprehensive available information will be. The data and documentary material held on the effects of the busway are relatively good compared with many other projects, but many limitations remain. This is due to the partial nature of information produced and also the absence of any requirement (for example within the NZTA PPFM) to undertake post-implementation monitoring or to record and maintain accessible documentation in the post-implementation period.

Given these data qualifications, post-implementation monitoring indicated that out-turn benefits were higher than anticipated due to:

- Busway patronage increasing more rapidly than forecast.
- Bus services operating faster and more reliably than prior to the busway
- Reductions in post-implementation peak traffic volumes on the parallel SH1.

Out-turn projects costs were slightly higher than anticipated due to variations identified during project implementation.

Whilst it is often possible to say that measureable changes in prevailing conditions have occurred following the implementation of a project, it is much more difficult to attribute the cause of such changes. To determine causation, a series of detailed checks are necessary, including a comprehensive look at changes in background conditions and other (non-project) interventions over the period.

For virtually all factors a range of background changes could have influenced observed changes in pre and post-implementation conditions. No detailed examination of the potential impact of such background factors has been undertaken in this report.

The reliance on transport modelling for significant elements of economic evaluation also raises the question of how best to utilise modelling in the evaluation of post-implementation conditions. Ideally, a suitably detailed multi-modal model would have been used. In the case of the NB, two different models were used, namely the Auckland Public Transport (APT) model and the corridor SATURN traffic model were used for the original economic evaluation. The results from these

models have also been used in this review and in addition the Auckland Regional Transport (ART3) Model was run to estimate the strategic effects with and without the project (Annex A3.3).

The appropriate interpretation and operation of models is increasingly required for the review of large scale and complex projects. In the case of networks with substantial route or mode choice particularly in major urban areas, modelled overall estimates of traffic volumes, travel times and other key variables are required to supplement 'measurable' information gathered through monitoring surveys at specific locations.

It is important to note that this review has been based largely on monitoring information from the early post-implementation period and that no comprehensive revision of future year modelled forecasts has been undertaken.

However, even if all forecasting was to be re-run retrospectively, limitations will always remain in the ability of models or any other analytical techniques to accurately predict future conditions. For interpretation purposes therefore, it is important to understand the nature of the modelling undertaken, the assumptions used, and the basis on which forecasts have been prepared. All these need to be systematically recorded in project documentation and to be easily accessible for later review to allow the underlying reasons why (say) a BCR has either been under or over predicted.

3.3 Evaluation Method

Spreadsheet based evaluation tests have been undertaken, as follows:

- Original PEM technique as used in the 2004 evaluation (which has 2001 values). Note: this evaluation method had to use some non-standard methods, in other words, outside the PEM/ATR procedures applying at the time. The original evaluation worksheets have been obtained for this task.
- Current EEM based techniques using 2011 values, with some variations in methodology for sensitivity test purposes.

For PIR purposes early post-implementation monitoring and adjustments to the original forecasts has been used with the original evaluation methodology, to establish if there any differences between this 'actual' BCR and the 'forecast' BCR at the time of funding approval.

As well as checking the original evaluation in the light of actual post-implementation data, seven sensitivity tests (on the basis of an 'infrastructure only project') have been undertaken. These tests (Annex A2.2, A2.3 and A2.4) review the potential effects of combinations of the following elements:

- Original Methods and Forecasts (as used in the 2004 economic evaluation)
- Actual effects (especially in terms of post-implementation PT patronage and general traffic conditions)
- Revised forecasts (adjusted forecasts as a result of adjusted trend projections).
- Updated procedures (in terms of the content of the current EEM, including updated cost and benefit values and equity of time.
- Additional benefits (i.e. not used in the original evaluation) including reliability, added congestion and agglomeration, see full discussion in Annex A2.1.
- Extended evaluation period (up from 30 years to 60 years, as per the UK).
- Reduced discount rate (down from 8% to 4% which is a sensitivity test within the existing EEM but even this lower threshold is still higher than in most other countries).

It should be noted that if any of the above changes in methodology were introduced in the EEM, they would need to be applied to all project types. This may mean that any increase in the BCR of PT projects through the adoption of alternative assumptions would not necessarily result in an increased funding priority being given to PT projects.

Two sensitivity tests have also been undertaken which treats the NB project as an integrated package of infrastructure, stations and services. These tests include operational PT service costs and revenues (Annex A2.5).

3.4 Cost Benefit Analysis Results

Original Evaluation and PIR – Project Infrastructure Only

PIRs are usually undertaken shortly after project implementation and therefore require a range of future assumptions to be made for the remainder of the evaluation period. For large complex projects this means that a degree of reliance is placed on the use and adjustment (where necessary) of modelled forecasts. There are also two novel features of the PIR undertaken, firstly the NB is a major project and secondly it is a PT project, making this ‘a first’ in two senses.

For PIR purposes, the costs of the project have been taken from the construction funding application and have been checked against post construction NZTA records of actual costs. Post-implementation monitoring data has also been compared with original forecasts and the resultant range of user and non-user benefits considered.

This PIR investigation used the original procedures (i.e. the project evaluation manual (PEM) and the alternatives to roading (ATR) manual) and original techniques (the original calculation worksheets) and found that the originally methodology used was robust.

The original evaluation primarily considered the project in terms of busway infrastructure (i.e. excluding services and effectively treating the project ‘as a road’) and only included a narrow range of potential benefits². The post-implementation monitoring found that out-turn projects costs were slightly higher (6%) than anticipated due to variations identified during project implementation.

The monitoring data also indicates that out-turn benefits are 18% higher than anticipated due to:

- Busway patronage increasing by more than forecast.
- Bus services operating faster and more reliably than prior to the busway
- Reductions in post-implementation peak traffic volumes on the parallel SH1.

The actual outturn costs and post-implementation monitoring information was used to recalculate the BCR for PIR purposes and this produced a corrected out-turn BCR of 1.3.

Infrastructure Only PEM/ATR 2004	Original Forecasts	Actual Effects Revised Forecasts
	<i>Scenario A</i>	<i>Scenario C</i>
Benefit Cost Ratio	BCR 1.2	BCR 1.3

The recalculation of the original evaluation³ in terms of actual monitoring data can be summarised as follows:

Cost Change	Benefit Change	BCR Change
+6%	+18%	+12%

² There was also a slight change of scope between the original evaluation and the award of construction funding, but this is not considered to significantly affect the results of the cost benefit analysis undertaken.

³ Costs and benefits discounted back to a common year for evaluation purposes. This means that the costs are not the same as pre-implementation cost estimates or post-implementation recorded out-turn costs. See also Annex A2.3

This is good in terms of predictive accuracy, when comparing immediate pre- and post-implementation conditions.

Additional Sensitivity Testing – Project Infrastructure Only – Current Practice

Additional sensitivity testing using the current version of the EEM and actual post-implementation monitoring data were also undertaken with the following results:

- Applying current EEM techniques (especially the extension of evaluation period from 25 to 30 years and the reduction in discount rate from 10% to 8%) to the original forecasts produced a BCR of 1.5.
- The use of actual patronage growth, application of current EEM techniques and equalisation of modal travel time values, further increased the BCR to 1.8.

Infrastructure Only EEM 2011	Original Forecasts	Actual Effects Revised Forecasts
	<i>Scenario B</i>	<i>Scenario D</i>
Benefit Cost Ratio	BCR 1.5	BCR 1.8

These results indicate that evaluating the NB project using current evaluation procedures, ‘evaluation conventions’ and using more accurate forecasting methods produce higher BCRs.

Additional Sensitivity Testing – Project Infrastructure Only - Extended Benefits/Evaluation Period and Reduced Discount Rate

Further tests to extend the range of allowable benefits, to extend the evaluation period and to reduce the discount rate were undertaken as follows:

Infrastructure Only Enhanced EEM	Actual Effects Revised Forecasts Extended Benefit Range	Actual Effects Revised Forecasts Lower Discount Rate Longer Period
	<i>Scenario F</i>	<i>Scenario H</i>
Benefit Cost Ratio	BCR 2.6	BCR 5.2

The extension of allowable benefits, the extension of the evaluation period and the reduction in the discount rate had the following effects:

- An extended benefit range, including: reliability, health, option, peak spreading and agglomeration benefits (see full discussion in Annex A2.1) has the effect of increasing the BCR to 2.6.
- Applying an extended evaluation period (60 years) and a reduced discount rate (4%) further increased the BCR to 5.2.

Project Infrastructure Only - Summary

The total variation of the BCR range between 1.2 (the original BCR) and 5.2 (extending the range of benefits, evaluation period and reduced discount rate) may seem surprising, but this serves to illustrate the critical importance of background assumptions and methodology frameworks.

On the basis of the evaluation of project infrastructure only, current EEM methodology (i.e. a 30 year evaluation period and an 8% discount rate) and the extended benefit range (as described in Annex A2.1) the resultant BCR of 2.6 (Scenario F) appears to be fully justified in terms of post-implementation monitoring information and the application of good evaluation practice.

Package Approach to Cost Benefit Analysis

An experimental model has been developed to undertake cost benefit analysis of the NB when treated as an integrated ‘package’ (of infrastructure, facilities and services).

This acknowledges that the original evaluation of the scheme was partial, in both cost and benefit terms, and therefore the results from ‘infrastructure only’ economic evaluation are limited as real indicators of economic performance.

Package Evaluation Enhanced EEM	30 Years and 8% Discount Rate	60 Years and 4% Discount Rate
	<i>Scenario K</i>	<i>Scenario L</i>
Benefit Cost Ratio	BCR 1.4	BCR 2.6

Treating the project as an integrated package, in terms of the inclusion of additional costs, revenues and adjustments to the treatment of benefits, results in a viable BCR of 1.4 over a 30 year evaluation period at an 8% discount rate.

Increasing the evaluation period to 60 years and lowering the discount rate to 4% resulted in a substantial increase in the forecast package BCR to 2.6.

Concluding Discussion - Cost Benefit Analysis

It should be noted that the importance of the longer evaluation period is in many ways, closely related to the discount rate. At 8% for example, a longer evaluation period may have a relatively limited effect.

All scenario test results based on variations on the original evaluation method (i.e. treating it as an infrastructure only project) are described in Annex A2.2.

More details of the integrated package evaluation are provided in Annex A2.5.

4.0 Northern Busway: Wider Outcomes

4.1 Objectives

The Transfund NZ Board resolution in May 2004 included the following statement:

“(d) notes the benefits measured in the calculation of the BCR of this project do not fully capture its strategically significant contribution to a sustainable land transport system in Auckland.”

This recognised that economic evaluation is a very useful technique, but it is also important that the BCR is not regarded as the only decision making tool, especially for major investments⁴. Consideration also needs to be given to strategic objectives and non-monetised benefits, which can collectively be termed ‘wider outcomes’. Wider outcomes also need to be taken into account in a rigorous, quantified and evidence based way.

The project was a key component in the overall regional transport and growth strategies and was expected to deliver a broad range of benefits, not all of which could (or can) be satisfactorily monetised. At the time of funding application the project aims were to:

<i>Aims (from Board Paper)</i>	<i>Interpretation (by this review)</i>
<i>Increase accessibility to public transport.</i>	<i>To increase PT patronage and PT mode split.</i>
<i>Provide an alternative mode of transport between the North Shore and Auckland City.</i>	<i>To increase transport system resilience and mode choice</i>
<i>Reduce travel times of ...HOVs and bus users along SH1.</i>	<i>The primary aim was to reduce travel times by collective modes relative to general traffic.</i>
<i>Increase person carrying capacity of Harbour Bridge.</i>	<i>Especially in terms of increasing the capacity constrained peak direction person movements.</i>
<i>Minimise adverse environmental effects of private motor vehicle use.</i>	<i>This implies that mode shift in favour of PT will reduce traffic levels to reduce the environmental impact of general traffic.</i>
<i>Enhance activity in city centres by improving accessibility and capacity.</i>	<i>The implication is that increased numbers accessing centres will lead to additional activity especially in terms of economic growth.</i>

The Transfund Board paper considered the busway primarily in terms of the road element of the project; however the aims of the project could only be delivered through a package approach, involving the introduction of suitable infrastructure, stations, associated facilities and services.

⁴ Current NZTA assessment requirements include factors for strategic fit and effectiveness, in addition to efficiency.

4.2 Assessment

Wider outcomes have been assessed in terms of the original Board Paper aims as follows:

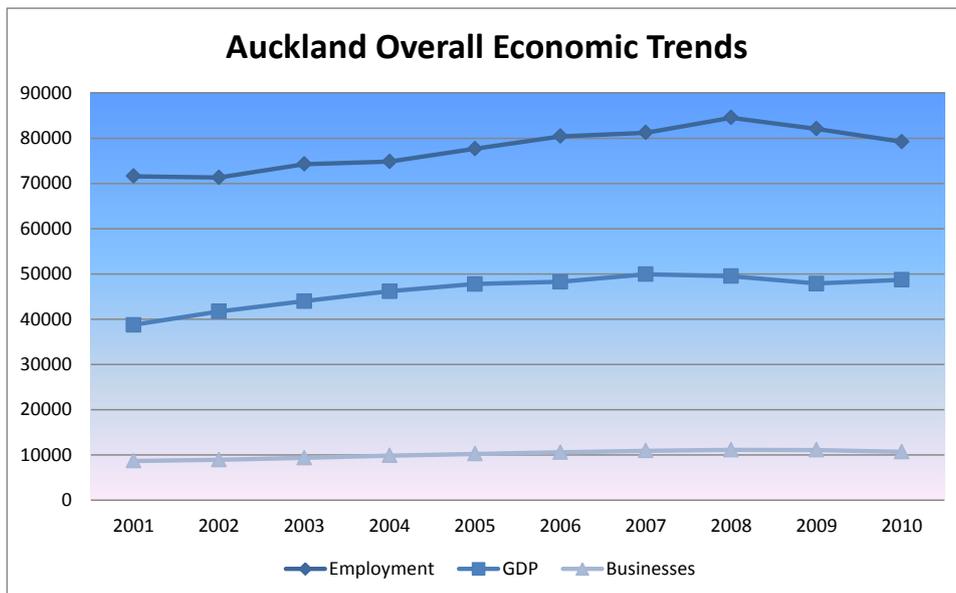
<i>Aims (from Board Paper)</i>	<i>Assessment (by this review)</i>
<i>Increase accessibility to public transport.</i>	<i>PT patronage has increased significantly and by more than forecast. PT mode split has also increased substantially and is on track to achieve the (then) ARLTS and ATP targets for 2016.</i>
<i>Provide an alternative mode of transport between the North Shore and Auckland City.</i>	<i>Transport system resilience has been increased over a section of SH1 north of the Harbour Bridge in terms of the ability to provide an alternative travel choice when blockages or delays (due to recurrent or non-recurrent congestion) are experienced by state highway traffic. Resilience is also increased by reducing car dependence and reduced reliance on oil in the event of changes in fuel availability or price. More frequent and reliable busway service, together with better bus interchange and greater park and ride capacity, has resulted in additional mode choice.</i>
<i>Reduce travel times of ...HOVs and bus users along SH1.</i>	<i>The primary aim was to reduce travel times by collective modes relative to general traffic. Potential HOV arrangements have not been implemented due to the success of the higher capacity bus based system. Bus travel times have substantially reduced.</i>
<i>Increase person carrying capacity of Harbour Bridge.</i>	<i>Capacity constrained peak direction movements have increased by 15%, mainly due to increased bus patronage but also due to an increase in car occupancy. Importantly, the potential for further growth (particularly through additional PT travel) has been created.</i>
<i>Minimise adverse environmental effects of private motor vehicle use.</i>	<i>Mode shift in favour of PT has reduced traffic levels on the parallel SH1 substantially. This is an important finding as quantified post-implementation evidence of such traffic reduction effects is rare. In turn, this reduction in traffic volume can be expected to have reduced the environmental effects of road traffic.</i>
<i>Enhance activity in city centres by improving accessibility and capacity.</i>	<i>The increased peak person movement capacity over the Harbour Bridge helps to support CBD activity, footfall and employment growth. The busway allows North Shore residents to access opportunities in the CBD</i>

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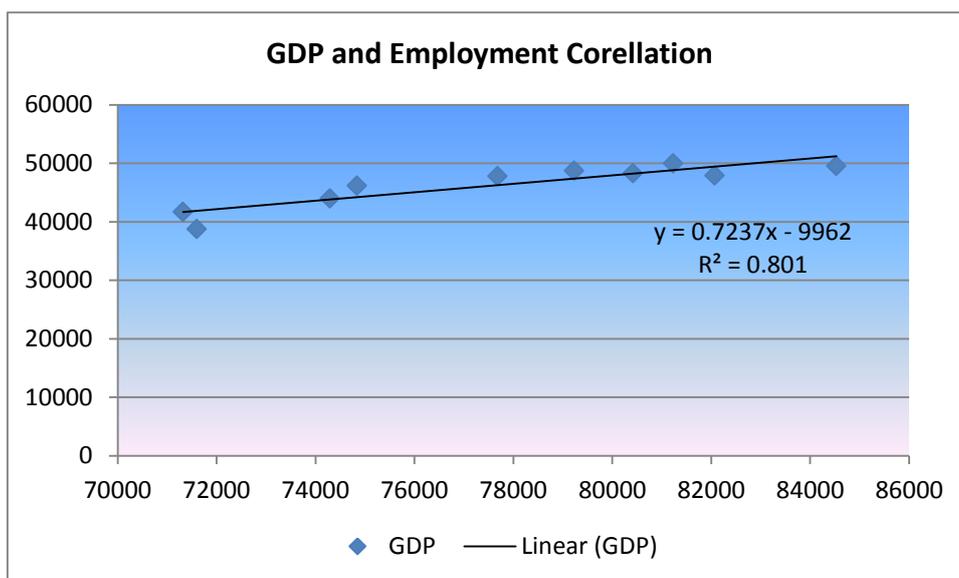
Economic Effects

It can be expected that the substantial and successful PT intervention represented by the NB will have resulted in economic effects, particularly on the CBD, that are additional to the economic valuation of transport benefits as contained in the current EEM. This view is supported by the literature review, for example: ".....a doubling of public capital investment has been found to lead to between 5% and 30% increase in productivity which suggested a sustained 10% increase in public transport investment would have long-term impacts of between 0.7% and 3.7% of GDP." (11)

Difficult though WEBS are to calculate, the working hypothesis is that if more people enter the CBD in the peak period (approximately +15% over the period under review) and this is likely to act as a stimulant to the economy in a number of ways. For example, the graphs below illustrate trends in economic data, covering Auckland CBD employment, number of businesses and the regional GDP over a 10 year period 2001-2010.



The data also suggests a close relationship between GDP and employment, illustrating correlation rather than necessarily causation, as shown below:



The dominant factor in driving CBD employment appears to be regional GDP growth, as changes in employment tend to follow changes in general economic conditions.

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Although there is an upward trend in employment that co-incides with the introduction of NEX / NB (over the period 2005-2008) this is unlikely to have been the direct cause of any substantial employment growth.

Given the real peak period constraints approaching the Harbour Bridge over the period prior to the introduction of the NB, the effect of the new services appears to have allowed in increases in demand for CBD employment to be met by North Shore PT commuters. The Fanshawe Street approach to the CBD has contributed by far the greatest increase in PT peak period commuters to the central area passengers over the period 2005 to 2010. Recent surveys⁵ show that, shows that Fanshawe St PT services accounted for 73% of the total growth in peak period travel by PT into the CBD over the period 2005 to 2010.

This matching of employment demand with peak commuter supply is likely to have allowed the CBD to continue growing (to achieve intensification, planning and sustainability objectives) and to have allowed further agglomeration and economies of scale to be generated by central businesses.

The increase in PT travel from the North Shore, together with inner city apartment supply and the decrease in free or cheap parking for students, is likely to have contributed significantly to the growth of the education sector in the CBD (there are currently over 60,000 full or part time registered students).

NB related PT travel growth is also likely to have contributed to other economic sectors within the CBD, such as increased retail, leisure, events and entertainment trip making.

Congestion

Irrespective of the economic analysis of economic and environmental costs, congestion is also regarded as important factor in quality of life terms. Consequently, the desire to reduce congestion is a substantial driver of transport funding policy and a major justification for the introduction of PT improvements.

Despite this, it is difficult to forecast, or to establish through monitoring how effective transport system improvements have been in reducing actual congestion levels. There is certainly the potential for congestion relief initiatives to be very significant, but this depends very much on the nature of the intervention and prevailing network conditions.

Models and average EEM values have difficulty in accurately reflecting congestion and the effects of measures (such as PT initiatives) that are intended to reduce congestion severity.

In the case of the NB the presence of severe peak period congestion on SH1 to the north of the Harbour Bridge creates the potential for substantial mode transfer and travel time savings to occur. From post-implementation traffic volume data there is good evidence that the introduction of the NB has reduced peak traffic volumes on SH1 (Annex A3.2) by around 5%. This is significant, especially when contrasted with the traffic growth that is likely to have occurred in the absence of the NB.

Post-implementation monitoring data confirms that bus travel times have reduced substantially (by approximately 10 minutes) as a result of the NB, but evidence on travel times for general traffic on the parallel SH1 is inconclusive. This is partly as a result of the limited nature of the speed monitoring data available, and partly because the increase in travel times (recorded post-implementation) will have been affected by unrelated road works south of the Harbour Bridge.

⁵ Passenger Transport Patronage Surveys, Screenline 70 Inbound, Appendix A, August 2010.

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Overview

It is very important that economic evaluation (as represented by a BCR) is not used as a single decision-making tool, especially for major PT investments.

There are various reasons why some benefits cannot be monetised, for example if they require highly complex methods to be identified or if they cannot be reliably monetised.

Despite this, it is often possible to quantify or scale effects so that they may be measured and used in assessments. Important that this assessment is as rigorous and evidence based as possible.

At present the assessment of wider outcomes in NZ tends to be unquantified, generalised and subjective.

5.0 Conclusions and Recommendations

5.1 Conclusions

PT Procedures Review

Economic evaluation techniques in NZ have been developed and progressively improved over the past three decades. Originally developed for road projects, the EEM now contains a range of PT methodologies to value benefits in monetised terms. The PT procedures have developed since 1997 but a BCR method for PT that is 'reasonably consistent' with international procedures) has only been in place since 2006.

Some caution is needed in any revision of evaluation procedures and a range of different project circumstances need to be considered. However it appears that current PT evaluations in NZ often do not make full use of the potential offered by existing procedures, and rarely are comprehensive evaluation of major PT packages (infrastructure, facilities and services) undertaken.

NZ PT economic evaluation procedures would benefit from further development in the following ways:

- The EEM manual could be integrated and restructured to improve the consistency and clarity of advice.
- The range of explicitly allowable benefits (including option values) could be extended.
- Changes to the valuation of benefits (for example, the equalisation of modal travel time) are needed.
- A lower discount rate is required (say to 4%) to be more consistent with market conditions.
- For major infrastructure, a longer evaluation period is needed (say to 60 years) to better reflect the long term nature of major investments.

It is important that the BCR is not used as a single decision-making tool, especially for major PT investments⁶. There are various reasons why it may not be possible to fully monetise PT benefits, for example, when highly complex methods are required or where background research is not yet available.

Despite this it is often possible to quantify or scale effects so they may be measured and used in assessments. It is important that this assessment is as rigorous and evidence based as possible. At present there is no such method in NZ and PT assessments with respect to non-monetised economic or other benefits tend to be subjective.

Northern Busway: Cost Benefit Analysis

The original evaluation methodology treated the NB proposal as a road infrastructure project and did not evaluate the costs of PT service changes or the full cost of the stations. This was not regarded at the time as 'an ideal' approach and was designed to meet funding rule constraints at the time. Here it should be noted that subsequently, the EEM has been revised, but still requires further development to enable robust comparisons between different modes to be made.

Original Evaluation and PIR – Project Infrastructure Only

The NZTA PIR requirements are for the original evaluation methodology to be retested in terms of actual performance monitoring data, to compare with the originally forecast BCR.

⁶ Current NZTA assessment requirements include factors for strategic fit and effectiveness, in addition to efficiency as represented by the BCR.

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The results from this testing show that the out-turn BCR of 1.3 was slightly higher than the original BCR of 1.2. This was due to costs being 6% higher than originally estimated and out-turn benefits being 18% higher than forecast.

The original evaluation was therefore found to be robust and sufficient to permit assumptions and methods to be sensitivity tested. These sensitivity tests represent variations (in the most part improvements) in the potential application of economic evaluation techniques as follows:

Additional Sensitivity Testing – Project Infrastructure Only – Current Practice

Additional sensitivity testing using the current version of the EEM and actual post-implementation monitoring data were also undertaken with the following results:

- Applying current EEM techniques (especially the extension of evaluation period from 25 to 30 years and a reduction in discount rate from 10% to 8%) to the original forecasts produced a BCR of 1.5.
- The use of actual patronage growth, the application of current EEM techniques and the equalisation of modal travel time values, further increased the BCR to 1.8.

Additional Sensitivity Testing – Project Infrastructure Only - Extended Benefits/Evaluation Period and Reduced Discount Rate

- Extending the benefit range to include a greater range of potential benefits (such as peak spreading, improved PT reliability and option values) raises the BCR to 2.6.
- If a lower discount rate of 4% was adopted and a longer evaluation period of 60 years was adopted, these changes would result in a BCR of 5.2.

Project Infrastructure Only - Summary

The total variation of the BCR range between 1.2 (the original BCR) and 5.2 (extending the range of benefits, evaluation period and reduced discount rate) may seem surprising, but this illustrates the importance of background assumptions and methodology selection.

The evaluation of project infrastructure only, applying current EEM methodology and an extended benefit range produces a BCR of 2.6. This appears to be fully justified in terms of post-implementation monitoring information and the application of good evaluation practice.

Package Approach to Cost Benefit Analysis

Treating the NB project as an integrated package, in terms of including additional costs, revenues and adjustments to the treatment of benefits, results in viable BCR of 1.4 over a 30 year evaluation period at an 8% discount rate.

Increasing the evaluation period to 60 years and lowering the discount rate to 4% resulted in a substantial increase in the forecast BCR to 2.6.

Northern Busway: Wider Outcomes

Cost benefit analysis is very important but, on its own, cannot be used to develop strategy or to make informed decisions on individual projects without being viewed in the context of broader strategic planning. Detailed evaluation is only effective if it is undertaken within a strategic context⁷.

The NB achieved its wider aims including:

- Provision of a fast and attractive mode choice and consequently, an increase in system resilience.
- Increased person movement to overcome capacity limiting effect of SH1 between North Shore and the CBD.
- The creation of potential for continued patronage growth into the future.
- Increased CBD activity, employment and economic growth

5.2 Recommendations

- Advice is issued by NZTA to encourage PT evaluation to be undertaken on a more comprehensive basis, including the findings of this review with respect to the treatment of benefits and packages.
- The EEM is revised to incorporate more comprehensive advice on public transport, including recognition of the need for improved methods for application to major urban public transport projects.
- A comprehensive restructuring of the EEM is undertaken to improve the consistency of approach to the evaluation of different modes.
- Consideration is given to extending the evaluation period and reducing the discount rate for major infrastructure investments.

⁷ Current NZTA assessment requirements include factors for strategic fit and effectiveness, in addition to efficiency.