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SAHA

NZ Transport Agency

Roads of National Significance

Economic Assessments Review

Summary Report

July 2010

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Disclaimer

Saha International Limited (SAHA) has prepared this report as a summary version of SAHA's full report – Roads of National Significance – Economic Assessments Review May 2010 in consultation with the NZ Transport Agency (NZTA) for the purposes of public dissemination.

The underlying data to SAHA's assessment, specifically the conventional transport economic assessments, regional wider economic benefits and the CGE modelling, has been collected and developed by other external advisers engaged by NZTA. SAHA has relied on those assessments in the preparation of the full report, and subsequently this summary report. Therefore, this report provides high level analysis only and does not purport to be advice on particular investment options or strategies.

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1 Introduction

This report provides information on the findings of an economic assessment undertaken for the Roads of National Significance (RoNS).

The assessment includes consideration of the total economic benefits and costs for the seven RoNS taking into account traditional road user benefits, externalities, and potentially broader productivity and economic growth associated with the implementation of the RoNS.

The purpose of undertaking the assessment is to answer two fundamental questions, namely:

1. Are there quantifiable wider economic benefits associated with the portfolio of RoNS projects?
2. If such benefits exist and are quantifiable, are they of sufficient scale to demonstrate the economic worth of an aspirational RoNS implementation program?

1.1 What are the RoNS?

The New Zealand Government has announced seven Roads of National Significance projects, which have been identified as essential routes that require priority treatment to achieve higher economic growth and enhanced productivity.

The RoNS, from north to south, are:

- Puhoi to Wellsford – SH1
- Completion of the Auckland Western Ring Route – SH20/16/18 (including Waterview)
- Victoria Park Tunnel – SH1
- Waikato Expressway – SH1
- Tauranga Eastern Link – SH2
- Wellington Northern Corridor (Levin to Wellington) – SH1
- Christchurch motorway projects

The RoNS have been identified as the most essential routes from a nation-wide perspective that require significant development to reduce congestion, improve safety and support economic growth.

The purpose of the Government nominating these roads as “nationally significant” is to ensure they are given priority by NZ Transport Agency (NZTA) in developing the National Land Transport Program (NLTP).

NZTA has developed an aspirational implementation plan that would see the RoNS substantially advanced over the next ten years.

1.2 What are the objectives of this economic assessment?

The RoNS are each significant projects in their own right. Each has been progressed to a certain extent on an individual basis, and in a traditional approvals and procurement approach the funding for each would be assessed and sought in isolation from other major roading projects within NZTA's portfolio.

Due to the priority required for the RoNS, NZTA has considered an approach which seeks to justify, on economic assessment grounds, the seven projects on a portfolio basis taking into account their expected benefits.

The objectives from this process are to quantify:

1. The total benefits of the combined seven RoNS as a portfolio; and
2. The benefits of delivering the RoNS under an aspirational timetable (i.e. within a ten year time horizon).

This report represents the findings from the economic assessment which responds to those objectives.

It is important to note from the outset that the assessment approach adopted extends beyond conventional project level benefit-cost analyses alone, and incorporates broader second order macroeconomic effects. Similar approaches to evaluation have been made to varying degrees primarily overseas, and while there is growing agreement that the concept of including wider economic benefits in the appraisal of projects is appropriate (as evidenced by the inclusion of one component of these, agglomeration benefits, in the most recent versions of the NZTA Economic Evaluation Manual), the details of the approach in general are still embryonic and evolving, and some of the components are still the subject of debate.

It is therefore important that the results be considered within this context. It is generally acknowledged that broad benefits may accrue to a project beyond those undertaken in a conventional assessment, and this report simply seeks to outline a framework for identifying those benefits and then reporting on the results of quantifying those benefits in a coherent and transparent manner.

2 Methodology

An economic assessment of the seven RoNS projects as a portfolio that takes into account both conventional and wider economic benefits requires a methodology that is readily understood and can be used for undertaking necessary sensitive testing and scenario analyses.

The series of steps undertaken in this assessment is summarised as follows:

1. Approaches used in other jurisdictions in relation to program level economic assessment and/or the application of Wider Economic Benefits (WEBs) identification and quantification have been researched in relation to the structure or framework used.
2. Assess WEBs associated with the implementation of the RoNS. Two approaches were used (one essentially used as a comparison against the other, that is, they were not used in an additive manner):
 - A regionally-specific WEBs assessment of the regional impacts of each of the RoNS in relation to agglomeration effects and land use changes; and
 - Computable General Equilibrium model (CGE) to estimate the size of the national economy-wide effects.
3. Establishing a portfolio economic assessment framework, incorporating existing conventional cost benefit analysis results and profiles, together with WEB results, using the two approaches described above, for each of the RoNS projects.
4. Preparation and presentation of the results so that the specific impacts of both broader economic impacts and project acceleration can be quantified and reported.

In accordance with the NZTA Economic Evaluation Manual (EEM) guidelines the following parameters were used in this assessment:

- A discount rate of 8% real; and
- An economic assessment period of 30 years from following construction completion of the project (in this case the construction completion of the RoNS portfolio).

All dollars are represented in 2009 dollars unless otherwise stipulated.

3 Wider Economic Benefits

3.1 What are Wider Economic Benefits, or WEBs?

Conventional cost benefit analyses focus mainly on the costs and benefits specific to a project, and are derived from changes in travel conditions including travel time, safety and vehicle associated costs. However, research in recent years has shown that these savings do not always fully capture wider economic impacts, and thus the exclusion of such impacts may raise the risk of less than optimal investment decisions.

The fundamental issues associated with the conventional approach have been the focus on transport model outputs only which distribute existing traffic flows and forecasts between routes and modes. These do not always take into account induced or generated traffic which may occur due to the particular impacts of the project or the second order economic effects which may arise in particular in response to changes in transport accessibility. The extent that the underpinning transport data which 'drives' a conventional approach does not fully capture estimates of changed socio-economic activity in terms of new trips or changes in patterns of economic activity, could be considered to be a deficiency with the conventional approach.

Research in recent years has shown that conventional analysis based on savings in travel time does not necessarily capture all wider economic impacts, and thus the exclusion of such impacts increases the risk of sub-optimal investment decisions. This is where the explicit consideration of WEBs seeks to respond to this deficiency in the conventional approach.

The national significance assigned to the RoNS program presents an opportunity to test an approach where a national road building program may indeed have a materially quantifiable impact on the national economy over and above those captured in individual (and conventional) economic appraisals. In terms of evaluating the value of the portfolio, these broader benefits should be identified and quantified as part of the economic assessment.

In this regard, the agreed definition of WEBs for this purpose is:

"Second order effects on wider economic activity", with examples of WEBs covering agglomeration benefits, labour productivity and supply, and the impacts of imperfect competition. In addition effects at a macro-economic level resulting in GDP changes or more specifically changes in Real Gross National Disposable Income (RGNDI) have been considered.

Two approaches to the evaluation of WEBs have been undertaken. These are:

- WEBs at a regional level using agglomeration and labour market effects; and
- Changes in Real Gross National Disposable Income (RGNDI) using a Computable General Equilibrium (CGE) model.

It should be noted that the outputs from these two methodologies are not considered to be additive to each other but rather demonstrate, through different means, the potential for additional economic benefits/impacts to be accrued to the RoNS program.

3.2 Regional Wider Economic Benefits

Regional WEBs comprise two principal elements not accounted for in conventional economic analysis. These are:

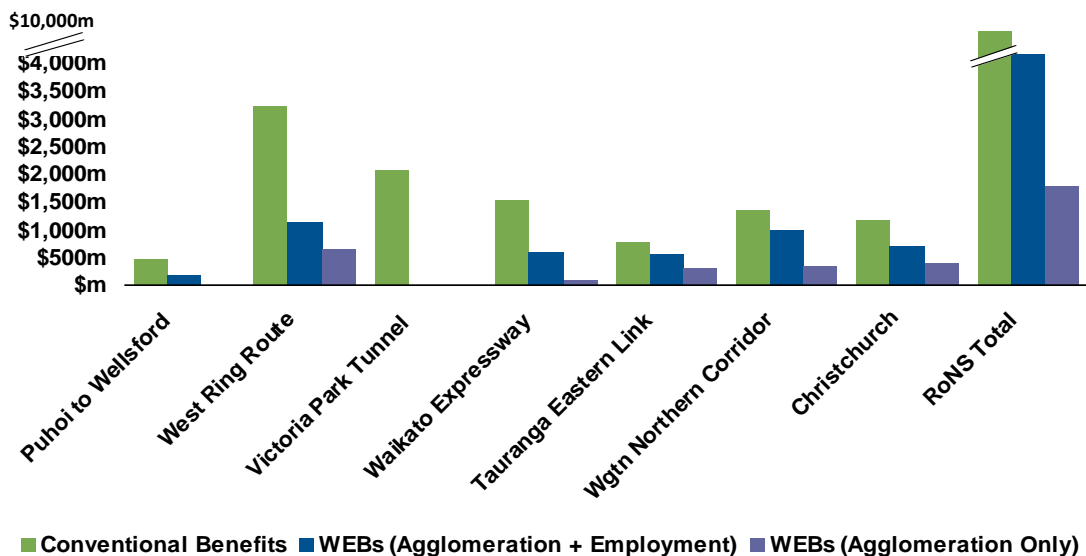
- Agglomeration impacts – the productive advantages that arise from close spatial concentration of economic activity, most likely to arise within major urban areas, and
- The impacts on employment levels experienced both within urban areas and more widely throughout the area of influence of the road project.

An estimate of the regional WEBs that would be generated by the RoNS was undertaken by Richard Paling Consulting.¹ This body of work indicates that such WEBs could amount to additional benefits in the order of 40 per cent of the value of benefits derived from the conventional economic analysis (on a present value basis across the evaluation period). Of these WEBs, the agglomeration benefits were estimated to amount to around 20 per cent or less of conventional economic benefits, a figure that is within the range typically found overseas. The employment impacts are larger but for these there is no typical range in relation to the quantum of these impacts.

While there are issues with the limited data available and with the use of results from different schemes and countries, the findings suggest that the WEBs from the RoNS are likely to be substantial when added to the benefits traditionally calculated for a road project. This result appears to support the priority and importance of the RoNS in improving productivity and raising economic output in New Zealand.

Figure 3.1 provides a comparison of the WEBs results on a present value basis for each of the RoNS projects under two WEBs scenarios – with and without employment effects, and against conventional benefits.

Figure 3.1 Present Value of Benefits – Conventional Benefits and Regional WEBs



¹ The Wider Economic Case for the Roads of National Significance (RoNS), Richard Paling Consulting Consulting, April 2010

Note that WEBs for Victoria Park Tunnel (VPT) were not assessed given that the purpose of this assessment has been to look at the effects of accelerating the RoNS, and as VPT is currently under construction at the time of preparing this report, there would be no incremental effect.

3.3 National Wider Economic Benefits

A computable general equilibrium (CGE) model was used by Infometrics Ltd to estimate national economic and productivity benefits generated by the RoNS program.² CGE is based on a benchmark of the economy based on interactions between economic agents including firms, workers, households, the government and overseas markets. By “shocking” the model, the changes in terms of GDP, employment and wages can be observed.

The main measure of economic welfare used in the CGE modelling is Real Gross National Disposable Income (RGNDI). RGNDI measures the total incomes New Zealand residents receive from both domestic production and net income flows from the rest of the world and adjusts for changes in the terms of trade. The inputs for the CGE model for RoNS includes change in work related travel time, vehicle operating costs and repairs and accident related costs.

For the RONS projects, Infometrics’ analysis using a ‘high’ scenario suggests that the generation of WEBs may be substantial, amounting to about \$1.4 billion per annum in 2020, some 80% increase in benefits over conventional transport related benefits alone.

The main driver of the expansion in economic activity is the enhanced resource productivity of transport-dependent commercial and industrial activities. As less time and money is spent transporting goods between suppliers and consumers as a result of the RoNS, between cities, and between ports and factories, more investment can be directed to increasing other productive assets such as telecommunications, infrastructure, and energy efficient appliances.

Industries that are critical to the economy such as dairy processing, forestry and tourism are key direct beneficiaries of better roads. The second round effects of more investment activity in these areas impact favourably on industries such as construction, base metals and metal fabrication.

Higher wage payments by these industries raise consumer demand, adding further impetus to the economic expansion. Ultimately better roads are considered to provide benefits to virtually all industries.

However, the existence of flow-on economic benefits depends crucially on whether there is an investment response to the potentially higher rates of return that would result from the productivity improvements generated by the RoNS. Without such additional investment, the CGE model forecasts no increase in the value of benefits over that estimated in traditional benefit-cost analysis. International best practice in general equilibrium modelling generally assumes that additional secondary investment does occur as a result of the initial stimulus resulting from the project.

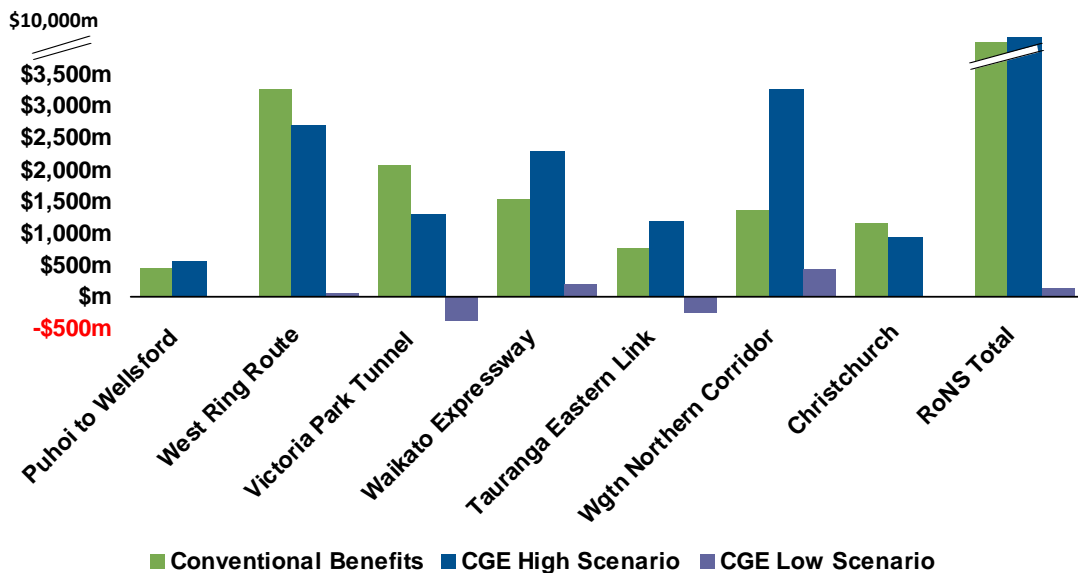
Figure 3.2 demonstrates the CGE output results at an individual project and also the portfolio level. The high and low scenarios are based on the capital closure assumptions, i.e. whether or not there is a secondary

² General Equilibrium Analysis of Roads of National Significance, Infometrics Ltd, December 2009 and May 2010

investment response to the potentially higher rates of return that would result from the productivity improvements generated by the RoNS. With such investment (high scenario) the total value of benefits of the RoNS increases by 80% in 2020 (that is in a single year) over the evaluation period the increase is forecast as 117% over that estimated by traditional benefit-cost analysis on a present value basis. However without such investment (low scenario), the model produces no increase in benefit value in 2020, with the total benefit value is 4% less than the conventional benefits. However, over the full project evaluation period, even under this low scenario, the addition of CGE benefits leads to an uplift of 1% in total benefits over and above the conventional benefits.

It is due to this broad variability in results that the CGE modelling has been used as one of two wider economic assessment approaches (the other being regional WEBS).

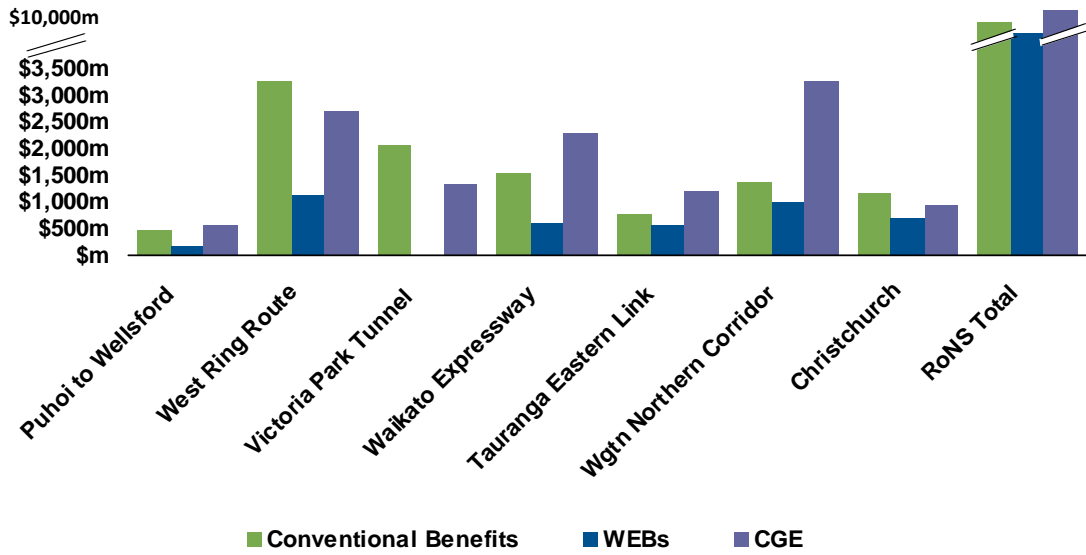
Figure 3.2 Present Value of Benefits – Conventional Benefits and CGE



3.4 Comparison of conventional and wider economic benefits

Figure 3.3 below provides a comparison of the present value of benefits for the aspirational scenario that are generated by the three evaluation methods, i.e. benefits generated by the conventional cost benefits analysis and the high estimates of the regional WEBS and CGE.

Figure 3.3 PV of benefits (Aspirational Program) – Conventional benefits, WEBs (agglomeration + employment), CGE (high estimate)



4 Combining the results

4.1 How are the methodologies used?

The economic evaluation of the RoNS incorporates conventional benefits and costs specific to each project, as well as WEBs which look at regional and national economic impacts.

Conventional economic appraisal assesses the cost and benefits of a project to the community, which are incurred by different stakeholders such as the project proponents, road users and the government.

The WEBs analysis undertaken at a regional level, and CGE model undertaken at a macro-economic level, attempt to capture the wider economic impacts of the RoNS, using two different approaches.

Wider economic costs and benefits have not traditionally been included in conventional cost-benefit analysis. However, there are increasing moves to include these impacts in some way, at least for large schemes. Standard approaches to the assessment of agglomeration impacts are evolving and are now included in the formal guidance for economic evaluation in New Zealand (by the NZ Transport Agency) in line with approaches in other jurisdictions. However the inclusion of employment impacts in conventional economic evaluations is still not conclusive, in part related to the difficulties associated with their estimation and potential double counting effects.

It also should be noted that the relationship between benefits derived from regional WEBs and those derived by the CGE model is at this stage unclear. It is probable that they are not additive to each other, but rather have been treated as two separate sensitivity tests over and above conventional results. It is acknowledged that further work on economic assessment more generally in dealing with WEBs benefits is required in this area.

For the purposes of this assessment, the estimates of both regional WEBs and CGE have been added separately, as a sensitivity test, to the conventional cost benefit analysis of the RoNS portfolio. The intention of adopting this approach has been to produce an indicative single investment measure that can be used to inform decision making with regards to the acceleration of the RoNS program. However the report writers note specific concerns and lack of precedents in adding WEBs and CGE to conventional CBA and emphasise such an approach provides an indicative outcome only and is not intended to be used as a conclusive investment validation tool.

4.2 Cost and benefit comparison of the programs

To assess the economic impacts of an accelerated or aspirational RoNS program, the evaluation results of an indicative aspirational program have been compared against an indicative “base case” or compliant program.

Figure 4.1 and 4.2 illustrates the different cost-benefit profiles of these indicative programs:

Figure 4.1 Cost and Benefit Profile – RoNS Compliant Program

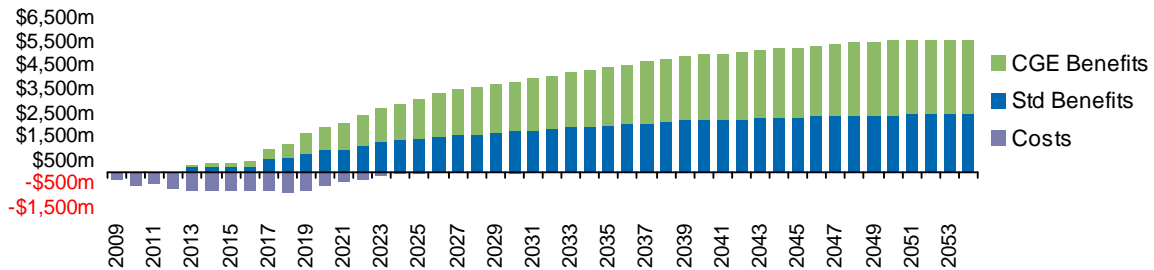
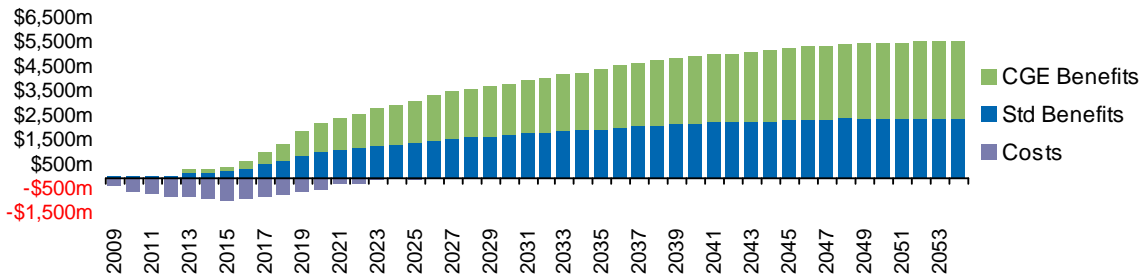


Figure 4.2 Cost and Benefit Profile – RoNS Aspirational Program



The figures show that as construction of the RoNS is accelerated, capital costs are brought forward, and benefits are realised sooner than the compliant program. These two effects (costs brought forward, benefits realised earlier) mean that the overall result of the indicative compliant and aspirational programs are very similar. That is, accelerating the program has little impact on the overall result and therefore is a realistic program delivery option from an economic standpoint. The following sections discuss the economic evaluation outcomes of the compliant and aspirational RoNS scenarios in more detail.

4.3 Measuring the RoNS

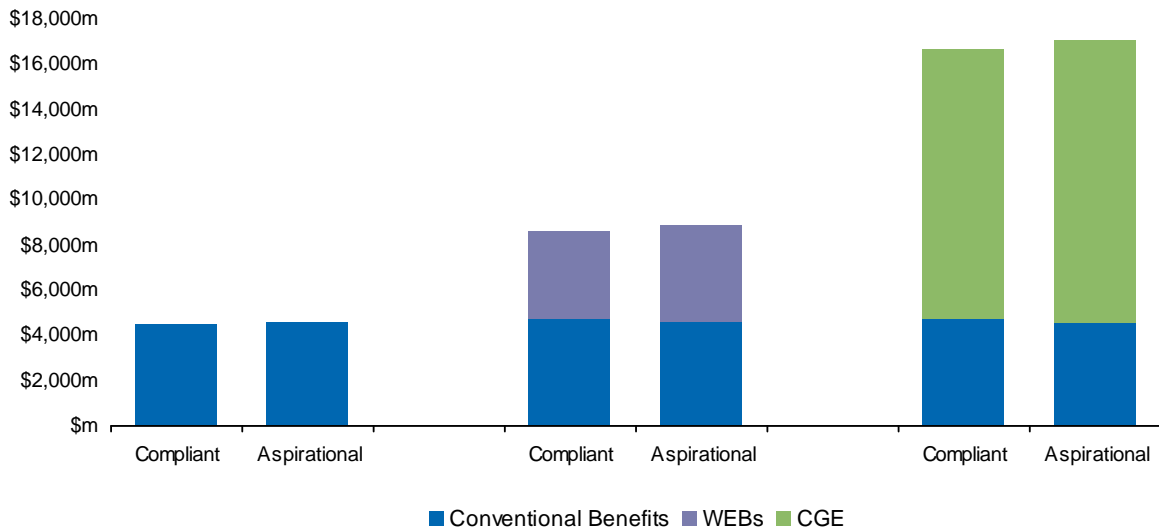
The outcomes of the analysis indicates that under conventional CBA the RoNS portfolio, for both the aspirational and compliant scenarios, delivers positive investment results with an NPV of over \$4.5bn and a BCR of 1.8 (that is, for every \$1 of capital invested, the portfolio generates approximately \$1.80 in return).

Both approaches to WEB estimation indicate substantial *additional* benefits may accrue to the economy from investment in the RoNS portfolio under both the aspirational and compliant scenarios.

Figure 4.3 summarises the results of the economic evaluation for the compliant and aspirational scenarios for the RoNS taken together under **three tests**:

1. Conventional Cost Benefit Analysis;
2. Conventional Cost Benefit Analysis plus regional WEBs; and
3. Conventional Cost Benefit Analysis plus GE benefits.

Figure 4.3 Net Present Value of the Compliant and Aspirational Scenarios



Key conclusions from the above analysis are:

1. The RoNS generate positive economic benefits under a conventional CBA approach;
2. The RoNS are likely to generate substantial *additional* wider economic benefits; and
3. There is not a statistically significant difference between the outcomes delivered by the aspirational and compliant scenarios. While the results indicate that there would not be a major difference to the economic outcome from delivering the RoNS under an aspirational program compared to a longer timeframe, if funds are available to invest sooner, economic benefits generated by the RoNS, both conventional and wider, can be realised sooner.

5 Conclusions

- i. Each Road of National Significance (RoNS) has been subject to a conventional economic assessment by NZTA considering traffic benefits, travel time savings, accident reductions, vehicle operating cost savings, and associated benefits and costs;
- ii. WEBs have also been identified and quantified at both a regional level and a national level, broadly consistent with the use of WEBs in program evaluation in other countries;
- iii. These WEBs are generated by the RoNS program beyond those estimated through conventional economic assessment, and are of relatively considerable scale;
- iv. Conventional assessments undertaken for each RoNS assessed at a portfolio level, indicate that **the RoNS portfolio generates positive economic benefits** with an NPV of over \$4.5bn and a BCR of approximately 1.8 (in other words, for every \$1 of capital invested, the portfolio generates approximately \$1.80 in return);
- v. Estimates of regional WEBs and of national economic and productivity benefits indicate that the **potential exists for further additional benefits to the economy generated by the RoNS** over and above conventional transport economic benefits;
- vi. There is not a materially significant difference between the outcomes of implementing the RoNS under an aspirational versus compliant timetable – the inclusion of WEBs does not change this outcome;
- vii. Notwithstanding this, the results indicate that the total benefits remain larger than total costs for the RoNS portfolio as a whole, whether delivered as an aspirational program or a compliant program;
- viii. The results indicate that there is no major difference in economic outcome in substantially delivering the RoNS within a ten year timeframe (an aspirational scenario) compared to a longer delivery timeframe. **Indeed if funds are available to invest sooner, economic benefits generated by the RoNS, both conventional and wider, can be realised sooner.**