

Technical Report 4

Sapere Research Group – Cost Benefit Analysis

Report prepared for Wellington International Airport Limited

Cost Benefit Analysis of the Proposed Runway Extension at Wellington International Airport

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Executive summary

In 1929, the runway at Wellington was sufficient for Tiger Moths; it was 350 metres long. The runway has since been extended five times to its current length of 2050 metres. As airline technology advanced, the runway was initially lengthened to allow domestic flights from Wellington to cities across New Zealand. In the 1960s and 70s, the runway was further extended for commercial jets to fly the Tasman – without that extension, the current services connecting Wellington to Sydney, Melbourne and Brisbane would not be possible.

Wellington International Airport Limited (WIAL) is considering lengthening the runway a further 355 metres, an increase of about 15 per cent on its current length. A longer runway would allow new generation aircraft, such as the Boeing Dreamliner or the Airbus A350/A330Neo, to fly directly from Wellington to cities in South East Asia, such as Singapore, or to south China, or to the west coast of the United States. Extending the runway would also allow aircraft currently using the runway to take-off carrying more passengers and freight or to carry existing loads with less stress on engines and brakes.

The potential benefits are considerable – more international visitors, more New Zealand residents travelling, less time lost in waiting for connecting flights, reduced costs to airlines operating out of Wellington, and potentially greater competition among airlines with the prospect of improved services and lower airfares for New Zealanders.

Extending the runway to make these gains possible would be costly – the runway would be pushed further out into Lyall Bay at a capital cost of approximately \$300 million, or around \$1 million per metre. There would be additional costs in providing goods and services to the increase in international visitors, and the works involved in extending the runway would have environmental, social (including recreational) and cultural impacts.

This report provides an economic cost-benefit analysis (CBA) of the proposed runway extension. It estimates the value of the nation's resources which would be used up in expanding the runway and providing goods and services to additional visitors, and compares those costs with the additional economic value made feasible by the extended runway.

Where possible, we quantify these costs and benefits and express them in dollar values. Where there is insufficient data to quantify the economic costs and benefits, we assess them in qualitative terms. The method we apply is that recommended by the New Zealand Treasury for assessing economic benefits and costs of major projects, and is informed by the guidance offered by similar agencies in Australia. The analysis was initially undertaken in November 2015, and updated in March 2016 following public consultation and submissions and a further round of internal review of key parameters.

We conclude that the real economic value added by the runway would substantially exceed its economic cost. Extending the runway would produce a net economic benefit for the country of around \$2.3 billion in today's dollars. Almost \$8 of economic benefit would be added for each dollar spent on lengthening the runway. These are national benefits. The major results are broadly in line with CBAs of runway extensions elsewhere and compare favourably to other infrastructure investments in New Zealand.

Wellington's existing function as a 'gateway' city would expand with the runway; a gateway city is the first place a tourist visits, but is not necessarily the sole or principal destination for

the tourist. We explain why the Wellington region might expect almost a third of the net benefits of the additional visitor expenditure – this would equate to between \$570 million (low scenario) and \$1.9 billion (high scenario). These would be significant economic benefits to the region.

This strong net benefit result is robust to a range of sensitivity tests. In addition, the economic costs and benefits which we assess qualitatively are largely positive; hence, the quantitative estimates we provide should be viewed as the minimum economic benefits identified in this study.

Economic efficiency gains from extending the runway

Extending the runway is expected to lower the economic cost for passengers and freight to travel via Wellington. It would do this by:

- Allowing “wide-bodied” aircraft, including long-haul code E sized aircraft, movements which are currently not possible due to the runway length, resulting in greater passenger and freight loads and lower cost per passenger or kg of freight.
- Reducing the (financial and opportunity) cost of supplying and accessing airline services, particularly “long-haul” services to Asia and the USA that currently involve additional link flights either domestically (e.g. Auckland or Christchurch) or internationally (e.g. Sydney, Melbourne or Brisbane).
- Lowering barriers to increased competition for airline services at Wellington Airport, thereby further increasing the efficiency with which airline services are supplied (e.g. by allowing more efficient carriers operating more efficient wide-bodied aircraft to offer more competitively priced airline services at Wellington Airport).
- Increasing the number of aircraft and passengers using Wellington Airport (e.g. international visitors to New Zealand and New Zealand residents using the airport to travel overseas) and altering patterns of use of airline services at Wellington Airport.

Achieving these efficiency gains would support a range of national and regional objectives, including:

- The economic development and strategic plans and aspirations of local authorities throughout Wellington and surrounding regions.
- Tourism 2025 framework targets around connectivity, in particular enhancing sustainable air connectivity and improving the distribution of tourism throughout New Zealand.
- Achieving the aims of International Air Transport Policy, especially in relation to continuing the process of air services liberalisation and enhanced competition in the provision of international air services.
- National Infrastructure Plan 2015 ambitions around integrated infrastructure and supporting a strong economy through international connectedness.
- Meeting the goals of the Leadership Statement for International Education to double the value of international education to the New Zealand economy through developing and sustaining mutually beneficial relationships in key markets (many of which overlap with likely direct services possible following the runway extension).

Improved equity of access to air travel

Reduced economic costs of air travel via Wellington would improve the equity of access of individuals and businesses in the Wellington region to affordable passenger and airfreight transport services. More affordable air travel would increase the travel options available to lower income individuals and families; there is evidence that lower income individuals and families benefit proportionally more from cheaper air travel than wealthy individuals and families.

Options to achieve these efficiency and equity gains

Over the years, many options for reducing the costs of air travel via Wellington have been explored. This report examines a short list of three alternatives against the base case (business-as-usual):

- Option 1: extend the runway, which would involve commencing construction of the extension around mid-2017 and the extended runway operating from 1 April 2020.
- Option 2: defer the runway extension, which would involve commencing the construction of the extension around mid-2027 and the extended runway operating from 1 April 2030.
- Option 3: promote Wellington Airport as a tourist and airfreight hub, which would involve establishing a fund, equivalent in present value terms to the present value of capital expenditure under Option 1; this fund would be used to promote Wellington Airport as a tourist and airfreight hub each year over the period 1 April 2020 to 31 March 2060 (i.e. for a period of time that is the same as the expected useful life of the extended runway).

Of the short listed options outlined above, only Option 1 and Option 2 are feasible solutions to the economic inefficiencies and distributional inequities arising from the restricted length of the current runway. Option 3 would aim to stimulate demand.

Passenger growth with and without the airport extension

The major input in all of the options considered is a set of air traffic forecasts – that is, passengers and aircraft movements. These forecasts were specifically prepared for the project by InterVISTAS, a specialist aviation consultancy. InterVISTAS produced information on passenger traffic, aircraft movements and resulting additional services (i.e. routes) for a “business as usual” or “base case” – that is, what would happen in the absence of the runway extension – and for what would happen with the runway extension. These forecasts were originally produced in October 2015 and were then revised following consultation and public submissions in March 2016. This report relies on the March 2016 forecasts.

Under the “base case”, the median or most likely forecast sees total passenger traffic at Wellington Airport grow at an annual average rate of 2.3 per cent per annum to 2060, reaching 9.4 million passengers in 2035 and 15.1 million passengers in 2060. Passenger traffic this year is 5.5 million, and the annual average growth rate from 1997 – 2015 has been 2.8 per cent.

The key difference between the ‘business as usual’ and runway extension case is the extent to which routes and markets are stimulated by the ability for airlines to introduce direct connections between Wellington and other cities. By 2060, the most likely forecast of the

runway extension scenario projects 1.13 million additional international passengers (total international passengers of 4.27 million with the runway extension and 3.14 million without the extension). There would be 461,500 fewer domestic passengers with the runway extension, as some passengers that would otherwise fly via Auckland or Christchurch would fly direct from Wellington to an overseas destination (domestic numbers are 11.5 million with the runway extension and 11.9 million without the runway extension).

Assessing all measurable costs and benefits

Our report estimates the net benefit to the nation of the proposed runway extension using a “gross” approach over a period of 40 years. A gross approach estimates the:

- Total additional economic costs that airports, airlines and users of airline services would incur under each of the alternative options – that is, the additional real value of the nation’s resources that would be used under each of the alternative options.
- Total additional economic benefits that airports, airlines, users of airline services and other sections of the community would derive under each of those alternative options – that is, the additional real value of output supplied under each of those alternative options.

The total additional economic costs are subtracted from the total additional economic benefits to estimate the net economic benefit of the proposed runway extension relative to the ‘business as usual’ case.

Results of the cost benefit analysis

The results of the cost benefit analysis are summarised in the table below. The “simple” benefit-cost ratio shows that, under the most likely scenario, benefits exceed costs for all three options. Relative to “business as usual”, the nation as a whole is made better off under all three options. Option 1, the runway extension commencing in 2017, has the highest benefit to cost ratio (BCR) of 2.3, followed by Option 2 (BCR of 2.22) and Option 3 (BCR of 1.9).

Option 1 produces the highest net benefit of \$2.3 billion, followed by Option 3 (\$1.6 billion). If the runway extension is deferred to 2027 (Option 2), the net benefit reduces to \$974 million.

We also report the ratio of net benefits to capital costs (NBIR), which is often of interest to budget holders and decision-makers. Again Option 1 stands out with net benefits of nearly eight times the capital costs of the runway extension.

Table 1 Summary CBA results (\$m present value, most likely scenario)

	Option 1	Option 2	Option 3
Total benefits	\$4,114	\$1,801	\$3,382
Total costs	\$1,790	\$827	\$1,790
Net benefits (NPV)	\$2,324	\$974	\$1,592
Benefit-cost ratio (BCR)	2.3	2.2	1.9
Ratio of net benefits to capital costs (NBIR)	7.6	5.4	5.2

How benefits are initially distributed

Table 2 shows how the net benefits are initially distributed among stakeholders. Under the runway extension as proposed (Option 1), the main beneficiaries are users of air services and the wider community. Users of air services benefit through reduced travel times, lower fares and charges, and greater frequency of services. The wider community benefits from the spending by additional visitors on goods and services and the GST collected on those additional sales.

Across all three options, the wider community stands to benefit most. The largest economic benefit from the runway extension is the value of additional visitor expenditure, which accrues to the wider community.

Table 2 Distribution of incremental benefits (\$m present value, most likely scenario)

	Option 1	Option 2	Option 3
Airports ¹	-\$222	-\$128	\$63
Airlines	\$6	\$3	\$0
Users	\$767	\$341	\$41
Other sections of the community	\$1,773	\$758	\$1,488
Total	\$2,324	\$974	\$1,592

Benefits to Wellington region

A cost benefit analysis necessarily focuses on national-level costs and benefits. However, it is reasonable to expect that the Wellington region will gain significantly from the runway extension as Wellington's role of a gateway city expands. We estimate tourists spend around 31 per cent of their holiday budget in their gateway city.

Hence, the Wellington region might expect almost a third of the net benefits of the additional visitor expenditure – this would equate to between \$570 million (low scenario) and \$1.9 billion (high scenario).

¹ Options 1 and 2 assume the total economic cost of the runway extension is allocated to airports for CBA purposes. This is separate from how those economic costs are funded/recovered.

Non-quantified impacts

Not all of the possible impacts could be quantified (and hence monetised). Nevertheless, they are important to the overall study. Our report considers, but does not quantify, a number of potential economic effects. These issues, and their likely effect if they were to be included, are as follows:

- *Increased competition for airline services to Wellington* – the increase in competitive rivalry from long-haul services into Wellington could be expected to substantially reduce price premiums paid by passengers due to limited connecting services to Wellington.
- *Business and migrant attraction* as a result of direct air links. The overall effect would be positive, and on some scenarios, could be significant.
- *Regional attraction of international students* – direct air links would make the Wellington region more attractive to international students. The overall effect at a national level would be modest, but from a regional perspective there would be beneficial upside.
- *“Democratisation of air travel”* with a greater proportional change in the propensity to fly for those on lower incomes. The overall effect is likely to be welfare enhancing, so possible minor upside.
- *Wellington as an option to divert* – the incidence of actual diversion would be very low; there is an existing alternative airport to divert to, meaning actual benefits relate to avoided processing delays which are marginal. The overall effect would likely be a minor beneficial upside.
- *Delayed infrastructure investment and regional redistribution* – by distributing passengers throughout the country, investment in infrastructure to cope with congestion could be deferred. In our view, this is likely to be a transfer or too immaterial to include in a quantitative sense. The overall effect would likely be positive, but minor.

These qualitative costs and benefits are largely positive and support, directionally, the quantitative findings; that is, quantitative estimates reported above should be viewed as the minimum economic benefits identified in this study.

While significant work has been completed in respect of environmental impacts (i.e. an effects assessment), we were not able to quantify and monetise these impacts. Hence, the cost and benefit estimates above do not include environmental impacts; these effects are discussed qualitatively.

Sensitivity of results to changes in key assumptions

We considered the extent to which the results of the cost benefit analysis are sensitive to changes in key parameters, such as:

- The capital costs of each of the options.
- Forecast numbers of additional aircraft and passengers visiting Wellington Airport.
- The real discount rate.

The forecasts produced by InterVISTAS included “low” (5th percentile) and “high” (95th percentile) scenarios derived using Monte Carlo simulation. The low scenario implies that there is less than a 5 per cent chance that traffic at Wellington will drop below the low scenario forecast (or a 95 per cent chance that realised traffic will be above the low scenario

forecast). Similarly, there is less than a 5 per cent chance that actual future traffic will exceed the high scenario forecast (or a 95 per cent chance that realised traffic will be less than the high scenario forecast).

Table 3 presents the results for the “low” scenario. The results are reasonably robust to changes in key parameters (i.e. the “simple” BCR is above one for all options). Table 4 presents the results for the “high” scenario, with similarly strong results. Further sensitivity analysis using a real discount rate of 10 per cent revealed that the BCRs for all options in all scenarios remained at or above one, though the low scenario for Option 3 was more marginal.

Table 3 Sensitivity of CBA results (low scenario, present value, \$m)

	Option 1	Option 2	Option 3
Total benefits	\$1,535	\$630	\$1,296
Total costs	\$946	\$414	\$946
Net benefits (NPV)	\$589	\$216	\$350
Benefit-cost ratio (BCR)	1.6	1.5	1.4

Table 4 Sensitivity of CBA results (high scenario, \$m)

	Option 1	Option 2	Option 3
Total benefits	\$6,301	\$2,736	\$4,978
Total costs	\$2,840	\$1,286	\$2,840
Net benefits (NPV)	\$3,461	\$1,450	\$2,138
Benefit-cost ratio (BCR)	2.2	2.1	1.8

In addition, we conducted further sensitivity analysis to determine whether the incremental economic benefits that existing users would derive from each of the options would exceed the additional capital costs of each option. This is essentially a test of whether the project “stacks up” from a purely Wellington-centric perspective (i.e. assuming that all the other benefits estimated could accrue just as easily to Auckland or Christchurch).

The key change assumption used was the proportion of existing long-haul users of airport services who would use direct flights. Under the “most likely” scenario, even if only 40 per cent of existing long-haul passengers and airfreight users used direct flights, the benefits would still outweigh the costs for Option 1 and Option 2 (there is essentially no benefit to users under Option 3).

Finally, we altered the extent to which New Zealand businesses gain from visitor expenditure (i.e. the “net benefit” component, which is assumed to be 75 per cent in line with government guidelines). Even where “net benefit” is slashed to 10 per cent, the BCR remains positive in all cases for the proposed runway extension.

1. Introduction

1.1 Purpose and structure of this report

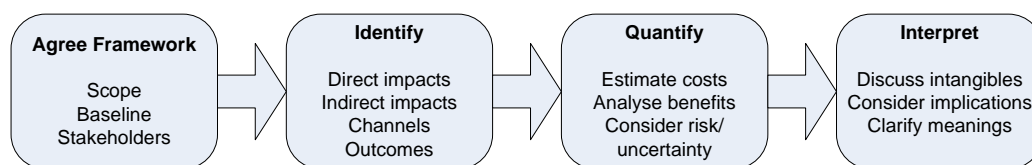
This report estimates the economic benefits and costs of the proposed runway extension. We organise our analysis into six sections as follows:

- This section outlines the method used and key assumptions.
- Section 2 outlines the problems the extension of the runway at Wellington Airport aims to address.
- Section 3 summaries the passenger and aircraft movements’ forecasts for the base case and runway extension options.
- Section 4 identifies the options considered to address those problems and the short list of options evaluated in this report
- Section 5 evaluates the incremental (i.e. additional) economic costs and benefits of each of those options relative to the “business as usual” or base case.
- Section 6 identifies the option expected to generate the greatest net benefits for the nation as a whole and explores how sensitive that preferred option is to changes in the key assumptions underlying the analysis.
- Section 7 discusses the implication for our analysis of alternative funding options.

1.2 Method

CBA is valued by decision-makers as it produces a clear understanding of the economic (resource) costs and benefits of particular proposals (i.e. whether society will be better off from the proposal). In addition, the results of CBAs are readily comparable across a range of policy and industry areas, enabling comparison (and prioritisation) of initiatives in a manner that is consistent and coherent. The basic framework is shown below:

Figure 1 CBA method



This report adopts a “gross” approach to estimating the net benefits of the alternative options. A gross approach involves estimating the:

- Total additional economic costs that airports, airlines and users of airline services would incur under each of the alternative options – that is, the additional real value of the nation’s resources that would be used under each of the alternative options.
- Total additional economic benefits that airports, airlines, users of airline services and other sections of the community would derive under each of those alternative options –

that is, the additional real value of output supplied under each of those alternative options.

The total additional economic costs are subtracted from the total additional economic benefits to estimate the net economic benefit of the proposed runway extension relative to the 'business as usual' case.

Only incremental benefits and costs are considered; that is, the analysis excludes effects that would occur in the absence of the proposal (e.g. baseline changes to air travel). The analysis is resource-based, and therefore does not include transfers (payments between parties that have no effect on resources – in effect, they offset each other for no economic gain). In addition, costs and benefits that do not accrue to New Zealanders are excluded from the analysis. We have drawn on a range of CBA guidance in the preparation of this report, which is outlined in Appendix 2.

1.3 Key assumptions and inputs

The key parameters used in the economic modelling are as follows:

- Period of analysis – financial year (FY) 2016 to FY2059 (where the financial year runs from 1 April to 31 March).
- Construction of extended runway:
 - Construction start date – FY2017 (i.e. calendar year 2017).
 - Construction end date – FY2020 (i.e. between December 2018 and 31 March 2020).
 - Commencement of operations – FY2021 (i.e. 1 April 2020).
- InterVISTAS forecast of passenger demand (discussed in Section 2 below).
- Real rates of increases in prices:
 - Real consumer prices – 0 per cent per annum (which in the presence of 2.5 per cent nominal price inflation implies that nominal consumer prices are increasing each year by 2.5 per cent).
 - Real capital costs – 1.5 per cent per annum (which in the presence of 2.5 per cent nominal price inflation implies that nominal capital costs are increasing each year by 4 per cent).
 - Real operating costs – 0 per cent per annum (which in the presence of 2.5 per cent nominal price inflation implies that nominal operating costs are increasing each year by 2.5 per cent).
- Real discount rate – 7 per cent per annum.²
- Present value of economic costs and benefits expressed in 2015/16 dollars.

² This is the rate recommended by the New Zealand Treasury for evaluating infrastructure projects, see <http://www.treasury.govt.nz/publications/guidance/planning/costbenefitanalysis/currentdiscountrates>

We also drew on a variety of independently produced inputs, from financial information on costs, air travel demand forecasts, aircraft performance and environmental and other impacts. These sources are contained in an information appendix to the report.

1.4 Revisions to the draft analysis

WIAL publicly released a raft of information on the proposed runway extension in November 2015, with consultation closing on 12 February 2016.³ Major responses (and associated commentary) relevant to our analysis were as follows:

- Board of Airline Representatives New Zealand (BARNZ) “*Wellington Airport Runway Extension.*” Response to Wellington Airport 12 February 2016.
- New Zealand Institute of Economic Research (NZIER) “*Stretching runway numbers- Review of cost benefit analysis of proposed Wellington Airport runway extension.*” Report to BARNZ, February 2016.
- NZIER “*Review of demand forecasts- Assessment of InterVISTAS Wellington International Airport Air Traffic Forecasts.*” Report to BARNZ, 10 February 2016.
- Michael Reddell “*If they build it what if no one comes?*” 27 November 2015; “*Further thoughts on Wellington airport- Part 1*” 8 December 2015; and “*Further thoughts on Wellington airport- Part 2*” 8 December 2015.⁴
- Tail risk economics “*The Wellington airport extension- A review of the cost benefit analysis.*” December 2015.⁵
- Keith Johnson “*Why Can’t Wellington Airport Pay for the Proposed Runway Extension?*”⁶

The responses (and commentary) cover a range of areas and standpoints, not all of which were amenable to being addressed in this report. For instance, some responses seemed to assess the CBA as a business case and, from this perspective, commented on the appropriate discount rate to use for individual firms. However, this analysis was neither conceived nor executed as a business case. It was prepared as a national CBA, using national and international guidance on CBA, which includes guidance on appropriate discount rates.

In addition, the question of who should pay for the proposed runway extension is not addressed directly in the analysis. The CBA is agnostic as to who should pay for the proposal; it is focused on national economic welfare as opposed to commercial or financial perspectives. The CBA does look at the (economic) implications of different funding options to the extent that available evidence allows, providing some insights into the likely welfare implications of different options. Further, more detailed, financial analysis would be needed for any business case or funding proposals.

³ <http://www.connectwellington.co.nz/reports>

⁴ <http://croakingcassandra.com/?s=Wellington+airport>

⁵ www.tailrisk.co.nz/documents/Wellington_Airport.pdf

⁶ <http://kjohnsonnz.blogspot.co.nz/2015/11/why-cant-wellington-international.html>

The key concerns raised in responses and by commentators relevant to our analysis were claims that our draft report contained:

- Optimistic forecast passenger and aircraft movement numbers.
- Incorrect treatment of additional tourist expenditure.
- Inappropriate values of travel time for existing (outbound) passengers.
- Excluded off-setting “losses” to the New Zealand economy from increased overseas travel by New Zealanders reducing onshore expenditure at a cost to New Zealand.

The responses and commentators contend that the net benefits estimated in the draft CBA were over-stated as a result of these factors. We address these concerns below.

1.4.1 Passenger and aircraft movement forecasts

The passenger and aircraft forecasts for this CBA were produced independently by InterVISTAS, a specialist aviation consultancy. InterVISTAS has revised their forecasts in light of the responses and the availability of updated traffic data from WIAL.⁷ The main questions raised in responses were whether the China and Other Asia forecast were too high, the viability of some routes included in the analysis, and whether the econometric model was “fit for purpose”. We do not rehearse the reply from InterVISTAS to these points. The most relevant aspect for our purposes is that the forecasts of additional passengers from China and Other Asia markets have been revised downward, with the result that the total forecast passenger and aircraft movements are reduced slightly. Further description of the forecast inputs is contained in Section 3 below.

1.4.2 Value to New Zealand from additional tourist expenditure

Additional tourists visiting New Zealand will produce a net economic benefit as they purchase goods and services from New Zealand businesses. Estimating that additional benefit requires (in addition to the forecast of additional passengers) a view as to how much each tourist will spend while in New Zealand; it also requires an estimate of the cost of the resources used up in providing the goods and services purchased by the additional visitors. In a CBA, the *net benefit* to the national or regional economy is calculated by deducting from the additional expenditure by foreign visitors an estimate of the cost of resources used up in providing those additional goods and services.

There is reasonably good data on how much tourists from different countries spend while in New Zealand, and our projections for expenditure appear non-contentious and attracted little commentary. There is much more uncertainty as to cost of the resources which would be used up in providing goods and services to the additional visitors.

⁷ InterVISTAS (2016) “*Wellington International Airport Air Traffic Forecasts- Forecast Updates, March 2016.*”

Estimating costs of additional goods and services

The reason for the uncertainty as to the additional costs is that a precise estimate would require information on the types of goods and services which would be purchased by the additional tourists, and the flexibility available to individual firms to service that additional demand in both the short and longer terms. Consider, for example, a tourist who spends \$1,000 in a hotel which has empty rooms and staff on shift anyway. The additional or incremental cost to serve the tourist is near zero, and most of the \$1,000 would be a net economic benefit, as the tourist contributes to recovering a sunk cost that has already been incurred (a small amount of additional costs might be incurred on consumable items such as replacing the soap in the bathroom).⁸

The example of the tourist staying in a hotel illustrates how the *incremental cost* of providing goods and services can be very different from the *average cost* of providing those services. In this simple example, the average cost per night could be calculated by summing up the total cost of providing the hotel's services, including the capital costs of the hotel, and dividing that sum by the number of guest nights. This average cost could conceivably be close to the \$1,000 charged by the hotel. However, the incremental cost to provide accommodation to a tourist, when the hotel has rooms available, may be very low, potentially just a few dollars. In other circumstances, the incremental cost could conceivably be higher than the \$1,000, if the hotel needed, say, to take on additional staff to meet the additional demand.

It is the incremental cost, rather than the average cost, which is relevant to estimating the net benefit from the additional expenditure from the increase in visitors to New Zealand, if the runway is extended. The theoretical methodology for how to estimate this incremental cost is explained in the economics literature – we step through this theoretical methodology in Appendix 3. However, it is not practical to obtain the information that would be needed to apply the theory as data would be needed on:

- The incremental goods and services the additional visitors would purchase (not just the amount of money they spend).
- The variable costs each business would face in the short-term to supply the additional visitors with the goods and services they purchase; that is, the incremental cost of supplying those goods and services.
- Any additional investment each of these businesses would incur to supply these additional goods and services and the incremental cost to those businesses after the investment is made.

This information is not available, and therefore other, less accurate, sources of information must be used, such as:

- Financial accounting data for businesses providing goods and services to international visitors.
- Data from the System of National Accounts.

⁸ This example is taken from NZIER, Review of Economic Analysis of the Wellington Runway Extension: NZIER report to BARNZ, the Board of Airline Representatives New Zealand Inc., 31 March 2015, page 7.

- Subsets of that national accounting data, such as the New Zealand Tourism Satellite Account data.

In our draft report, we estimated the proportion of expenditure by tourists – that comprises domestic net benefit – from the New Zealand Tourism Satellite Account data. We estimated this proportion by expressing the Department of Statistics estimate of the direct and indirect value added to the economy by tourism (i.e. \$10.6 billion plus \$7.9 billion) as a proportion of the value of goods and services (direct and indirect) purchased by tourists (i.e. \$27.4 billion and \$13.0 billion).⁹ This calculation resulted in an estimate of 45.9 per cent. We adopted this percentage, of value added from tourism expenditure as recorded in the national accounts, as a proxy for the net benefit which would result from additional expenditure by international visitors.

This proportion would imply, for example, that visitors from Australia would contribute, on average, \$65 a day in net economic benefit when in New Zealand.¹⁰ This result seems intuitively reasonable, and it is not difficult to conceive of examples where expenditure by tourists – on accommodation, transport, meals, and entertainment etc. – could add \$65 a day in economic net benefit to New Zealand.

In its draft guidelines for economic evaluations of major events, MBIE presently recommends a figure of 75 per cent for the value of international visitor expenditure that accrues to New Zealand (i.e. the draft guidelines assume the cost of goods sold is 25 per cent).¹¹ MBIE acknowledged that applying a uniform assumption may be incorrect in certain circumstances, “but it is highly unlikely to materially bias international visitor expenditure value add up or down.”¹²

MBIE published its guideline in 2013 to promote consistency and rigour in the economic evaluation of major events attracting additional visitors to New Zealand. It undertook a ‘meta-review’ of 18 events and found a wide range of methodologies had been applied in evaluating the economic benefits resulting from additional visitors.¹³ In recalculating these benefits, using its 75 per cent figure, MBIE arrived at an aggregate estimate of economic value that was just 22 per cent of the amount initially claimed by the event organisers and their consultants.¹⁴ Several of the event studies had wrongly assumed each \$1 spent resulted in a \$1 of benefit, or had applied a multiplier to account for indirect effects.

⁹ Statistics New Zealand, Tourism Satellite Account, 2015, figure 1.

¹⁰ Visitors from Australia spend on average \$1,500 on each visit and stay on average for 10.5 days, so $\$1,500 * 45.5\% / 10.5 = \65 .

¹¹ MBIE (2013) “*Major Events Development Fund – Post-event Economic Evaluation Guidelines*” Final draft for feedback. Available at: <http://www.majorevents.govt.nz/pdf-library/resource-bank/post-event-reporting/post-event-economic-evaluation-guidelines-320-kb-pdf>, page 21.

¹² MBIE (2013) “*Economic Evaluation Outcomes: Major Events Development Fund – Meta Evaluation Report*” Available at <http://www.majorevents.govt.nz/resource-bank/post-event-reporting/economic-evaluation-outcomes-meta-evaluation-report>, pages 21-22.

¹³ MBIE (2013) “*Major Events Development Fund – Post-event Economic Evaluation Guidelines*” Final draft for feedback. Available at: <http://www.majorevents.govt.nz/pdf-library/resource-bank/post-event-reporting/post-event-economic-evaluation-guidelines-320-kb-pdf>.

¹⁴ MBIE (2013) “*Economic Evaluation Outcomes: Major Events Development Fund – Meta Evaluation Report*” Available at <http://www.majorevents.govt.nz/resource-bank/post-event-reporting/economic-evaluation-outcomes-meta-evaluation-report>, page 5.

As a primary purpose of a CBA is to allow comparisons of initiatives across policy and industry areas (see discussion in Section 1.2 above), a lack of consistency in methodology, as is evident in these studies, undermines the usefulness of the CBA to decision-makers.¹⁵ There is, therefore, a case for adopting the present draft guidelines to achieve consistency in approach between this CBA and other assessments which estimate the net benefit from additional visitors.

In this context it would not be unreasonable to amend our net benefit (of every dollar additional visitor spent) from 45.9% to 75% notwithstanding that some submitters and commentators claim that the proportion of tourist expenditure counted as a net benefit to New Zealand in our draft report, 45.9%, was already too high (equivalently, the incremental cost of goods and services sold to tourists, at 54.1%, was too low).

That said, we understand that further work is being done by MBIE and that the guideline might be significantly amended before it is finalised.

NZIER approach

On behalf of BARNZ, NZIER argued that our estimate did not factor in the (opportunity) cost of labour and capital inputs. Drawing from national input-output tables and the Tourism Satellite Account, NZIER made a number of deductions from our estimate. The result is that NZIER suggest that just 12.9 per cent of each dollar spent by an international visitor should be counted as an economic benefit (compared with 75 per cent estimated by MBIE, and our draft estimate of 45.9 per cent).¹⁶

We explain in Appendix 3 why using national accounts data, in the manner applied by NZIER, results in an implausibly low estimate of the net benefits from additional sales to visitors. In summary form, the NZIER method compares ‘apples with oranges’. It does this by using an *average cost* estimate of the cost of all goods and services supplied in New Zealand, most of which are provided to New Zealand consumers, as a proxy for the *incremental cost* of meeting the additional demand by international visitors. This approach introduces several sources of error, including:

- The average cost of all goods and services sold in New Zealand provides a poor indicator of the typical costs of supplying the additional goods and services demanded by the additional tourists that visit Wellington. This is because the mix of goods and services purchased by international visitors differs from the mix purchased by locals.¹⁷
- There is likely to be a very large difference between the *incremental* cost of the additional goods and services purchased by the additional visitors and the *average* cost estimates used by NZIER. The additional value of goods and services purchased by the increase

¹⁵ This is way the New Zealand Treasury and its equivalents elsewhere publish guidelines on how to prepare a CBA (see CBA guidance listed in Appendix 2), and why MBIE has published its guidelines on key assumptions for estimating the benefits from additional international visitors.

¹⁶ NZIER (2016) “*Stretching runway numbers- Review of cost benefit analysis of proposed Wellington Airport runway extension.*” Report to BARNZ, February 2016, Table 5 p.25.

¹⁷ For example, the Tourism Satellite Accounts (table 8) suggest that international tourists spend a bit over 60% of their budget on accommodation, transport, and in establishments where food and beverages are served, whereas domestic tourists spend only a third of their budget on these items.

in international visitors would be only a tiny fraction (0.2 per cent rising to 0.9 per cent) of retail sales by New Zealand businesses,¹⁸ and most firms maintain capacity to meet some variations in demand (e.g. returning to the hotel example, NZIER's approach would include a share of the capital cost of the hotel room in estimating the cost of supplying hotel services to the additional tourists even if the room would be built regardless of the additional arrivals).

- The CBA is a multi-period analysis (the CBA looks out 40 years). The NZIER approach assumes that average capital and operational costs for all New Zealand firms supplying all goods and services, is representative of the incremental capital and operational expenditure necessary in *each* year to supply the additional goods and services to the additional non-resident tourists attracted by the extended runway. This assumption is highly unlikely; it would be more reasonable to assume that most New Zealand businesses have sufficient capacity to meet most of the additional demands on their businesses from the additional visitors, both in the short term and the longer term (when they are likely to be making their additional investment decisions on the basis of demands from their New Zealand resident customers and non-resident visitors that would have come to New Zealand anyway, in the absence of the runway extension).
- In making deductions using the input output tables, the NZIER calculation is likely to result in an element of double counting for depreciation – once when the depreciation expenses are included in the cost of supplying the additional services each year, and again when the real discount rate is applied to those higher expenses each year (since the real discount rate takes into account the opportunity cost of capital, which includes not only a return on investment, but also a return of capital “used up” in that year – that is, “depreciation”).¹⁹

Applying the NZIER estimate to the Australian visitor example would suggest that each Australian, on average, contributes only \$18.43 in economic net benefit for each day in New Zealand. If this were the case, all visitors from Australia (business, tourists, visitors to family and/or friends) would contribute just \$260 million annually in net benefit to the New Zealand economy.²⁰ Using the NZIER approach, this net benefit equates to just over \$925 million per annum in value-added (GDP) to the New Zealand economy.²¹ To put this number in context, Statistics New Zealand estimates that tourism adds \$18.5 billion to the economy annually, as measured by GDP.²² International tourism makes up about 39 per cent of the tourism sector (by expenditure)²³ and Australian tourists make up about 39 per

¹⁸ Retail sales were around \$58 billion in 2015, and the addition value of goods and services sold to additional visitors is projected to range from \$100 million in the earlier years to around \$500 million in the final year of analysis. See Appendix 3 for more comparator estimates.

¹⁹ This is why the standard guidance for CBA stipulates that depreciation should be excluded, for example, see paragraph 24 of the New Zealand Treasury's *Guide to Social Cost Benefit Analysis*.

²⁰ New Zealand Tourism data shows 14.2 million stay days per annum for Australian visitors, 14.2m x \$18.43 = \$261 million: New Zealand Tourism data available at: <http://www.tourismnewzealand.com/markets-stats/markets/australia>

²¹ Table 5 of NZIER, Review of Economic Analysis of the Wellington Runway Extension: NZIER report to BARNZ, the Board of Airline Representatives New Zealand Inc., 31 March 2015 shows that net benefit is equal to 28.1% of value-added. Hence, \$260 million/0.281 gives \$925.3 million in value-added.

²² Statistics New Zealand, Tourism Satellite Account, Table 1.

²³ Ibid, Table 2.

cent of the international tourism market. These percentages suggest that Australian tourists contribute around \$2.8 billion to GDP each year, a figure over three times that which would follow from NZIER's analysis.²⁴

Approach taken in final report

To some extent, elements of our criticisms above can also be applied to the analysis we presented in our draft report, as that analysis also drew from the Tourism Satellite Account data. In drawing from the Tourism Satellite Account, our estimates were also based on average costs and might have overstated the incremental cost of the resources that would be used up in meeting the incremental demand from the additional visitors. Certainly, our estimates were conservative (understated the benefits) relative to the present MBIE draft guidelines.

To ensure the consistency of the "headline" results of our analysis with those of other studies that follow the MBIE draft guidelines, we adopt the present recommendation for calculating net benefit at 75 per cent of each additional dollar spent. Use of a consistent approach would mean decision-makers could fairly assess alternative proposals and compare the scale of net benefits available from different projects.

If, as a result of the ongoing work, MBIE publishes revised final guidelines, it would be prudent to consider how any revisions might impact on our 'headline' estimates. In the interim, we are satisfied that our initial estimate of the net benefit of each additional visitor dollar spent is reasonably robust at 45.9%. In our sensitivity analysis, we show how the "headline" results would change if the net benefits were estimated at our original figure of 45.9 per cent, rather than the MBIE draft guideline estimate of 75 per cent.

As the estimated incremental cost of meeting the additional demand from the additional visitors that are forecast to visit Wellington as a result of the runway extension is uncertain, we present further sensitivity analysis. We show how the "headline" results would change if the incremental cost for the specific case of the runway extension were less than the MBIE draft guideline. We provide an assessment at 80 per cent, which also illustrates the effect of a relatively small change in this key assumption. In addition, we show how the results of our analysis would change if New Zealand businesses only derived a net economic benefit of 10 per cent of the additional expenditure by foreign tourists (a proportion that is even lower than that implied by the NZIER analysis of 12.9 per cent).

1.4.3 Value of travel time savings for existing users

Most of the key respondents and commentators noted that the values of travel time used in the draft analysis were considerably higher than available values of time for transport projects used in New Zealand. NZIER acknowledged that there is no available air travel value of time estimates for New Zealand and concede that air travel time might be valued more highly than land transport.²⁵

²⁴ $\$18.5 \text{ b} \times 39\% \times 39\% = \$2.8 \text{ b}.$

²⁵ NZIER (2016) *Op.cit.* pp.11-12.

However, NZIER still choose to include land transport values of travel time as feasible alternatives to the values we derived. In addition, NZIER provide further alternatives in the form of income-adjusted values of travel time without indicating their preference. Mr Michael Reddell and Tailrisk Economics also commented that our failure to account for income differences in the adaptation of Australian values (themselves derived from Europe) results in the draft report overstating the values of travel time.

Like the treatment of tourist expenditure, we identified travel time values in our draft report as an area for further internal review. Appendix 4 contains our further research. The evidence collected provides strong support for the values of travel time we used in the draft. It shows there are considerable differences between land transport and air travel values of time (a reasonable approximation is that air travel values are two to three times those for surface transport). In essence, land transport and aviation are “apples and oranges” and there is likely to be more similarity between New Zealand air travel values and overseas air travel values, than between New Zealand land transport and aviation values of time.

Further, the available evidence suggests that the difference between business and leisure values of travel time for land transport in New Zealand is significantly different (i.e. the leisure values are too low) from travel purpose values for aviation elsewhere. In short, land transport values of travel time are not especially relevant for our purposes and the difference between leisure and business travel values is relatively small for aviation. These relativities do not rely on income adjustments.

Appendix 4 contains a worked example to derive what might be appropriate values of travel time for air passengers if we start from the premise that New Zealand-based land transport values are relevant. Utilising the relativities between work and leisure values of time, and between air and surface transport, we derive travel time values for air passengers that are above those used in the draft report. The values used in the draft report are almost identical to those implied by NZIER’s income adjustment, after accounting for what is known to be the elasticity of the value of travel time to income changes and notwithstanding the fact that the elasticity relates to land transport as no air travel estimates are available. NZIER neglected to account for the elasticity of the value of travel time to income adjustments in their analysis.

Ultimately the question of appropriate travel time values is empirical. In the absence of such empirical work, judgment is required and differences of view are widely accepted in the available literature. Nonetheless, as detailed in Appendix 4, there is sufficient support for the values of travel time we used in the draft report for us to be comfortable continuing to use them in this final report.

1.4.4 Negative effects of overseas expenditure by residents

The submitters and commentators above also consider that the CBA should have accounted for the lost expenditure on local goods and services as a result of increased overseas travel

induced by the runway extension. NZIER acknowledge that there is no reliable basis on which to estimate this item, but nevertheless opine that it could be significant.²⁶

Putting aside the difficulty in establishing the spending patterns of New Zealander travelling overseas (and the need to determine the net benefits of such); there are three major reasons why a focus on “lost” expenditure overseas does not warrant further attention for this analysis. The first is that there are also welfare gains from residents who travel overseas, especially for leisure purposes (which make up between 83 and 96 per cent of travel by trip purpose in the analysis). It is not sufficient to include lost expenditure without also taking into account welfare gains to the traveller.²⁷

Second, it is not clear the extent to which expenditure on overseas travel would have been undertaken in the local economy in the absence of such travel. That is, there is no direct correspondence between spending overseas and a local equivalent. The overseas trip might be funded through lower savings or by foregoing purchases on imported items, such as a car or electronic equipment.

Third, there is the question of consistency. If, as NZIER claim, the opportunity cost of labour and capital of New Zealand retailers providing goods and services to tourists needs to be taken into account, then these costs also need to be netted off on foregone domestic consumption to avoid double counting, which NZIER does not do.

Finally, removing the runway ‘constraint’ on efficient delivery of aeronautical services would remove a non-tariff barrier to international trade in goods services, where the preferred transit point for those goods and services is Wellington. Reducing non-tariff barriers improves, rather than reduces, national welfare, as it reduces distortions in the exchange of goods and services.

On balance, we find little support for the proposition that reductions in domestic expenditure as a result of reduced cost of overseas travel should be included in the analysis.

1.4.5 Percentage of travellers flying direct

In addition to the above, we also re-examined the assumption that 80 per cent of outbound travellers would fly direct. This assumption drives the “volume” side of the travel time savings for existing users (the “value” side was discussed above). After further analysis, we concluded that 80 per cent was too high and have assumed instead that 60 per cent of outbound travellers would fly direct.

²⁶ NZIER (2016) *Op.cit.* p.13.

²⁷ As an illustration of an estimate of consumer benefit, MBIE recommend an estimate of 20% of the expenditure by residents on local events as a measure of their consumer surplus (that is, the benefit consumers obtain over and above the cost of the event).

2. Objectives of the project

2.1 The main problem

The main problem with the existing runway at Wellington Airport is that its restricted length imposes an economic cost on the nation as a whole by reducing the loads that aircraft using the airport can carry. The length of the runway:

- Reduces the volume of passengers, airfreight and fuel that can be carried by the “narrow-bodied” aircraft currently using Wellington Airport. These narrow-bodied aircraft carry passengers and airfreight over domestic and “short-haul” international routes (e.g. to the east coast of Australia and to Pacific Islands comparatively close to New Zealand such as Fiji).
- Precludes long-haul, code E sized, “wide-bodied aircraft” using Wellington Airport to carry passengers and airfreight over “long-haul” routes to Asia and the USA.

2.2 Economic efficiency of air services to Wellington increased if constraint removed

Removing the constraint imposed by the length of the current runway would increase the efficiency with which airport and airline services are:

- Supplied at Wellington Airport: through enabling the use of more technically and economically efficient wide-bodied aircraft and lowering the cost of using existing narrow-bodied aircraft (economists refer to these gains as increases in “production efficiency”).
- Used by passengers and airfreight users: efficient consumption of airlines services would be improved from lower costs, increased frequency of flights and new routes (economists refer to these gains as increases in “consumption efficiency”).

Each of these potential efficiency gains can alter the volume and value of airline and airport services supplied at Wellington. Additional benefits could occur through:

- Increased flexibility of airports and airlines to adjust to future changes in the economic environment (i.e. by increasing “dynamic efficiency”), including the ability to expand the supply of airport and airline services to meet unexpected future increases in demand, and the ability to adjust to changes in technology (e.g. aircraft types) and costs (e.g. the cost of fuel, labour and aircraft costs).
- Increased sales of goods and services to tourists who would not have visited New Zealand without the efficiency gains in airline services.
- Increased competition in the markets for airline services.

- Improving distributional equity by improving the access of individuals and businesses in the Wellington region to affordable, convenient, and demand-responsive passenger airline and airfreight services.

Achieving these benefits would promote outcomes sought by local and central government, including those contained in the:

- Wellington City Council's Long Term Plan 2015–25.
- National Infrastructure Plan 2015.
- Tourism 2025, the plan to improve the competitiveness of New Zealand Tourism.
- Manawatu and Whanganui Regional Growth Study.
- New Zealand Government's International Air Transport Policy.

In the following sections we discuss the potential for increases:

- In production efficiency (that is, lower costs of providing airline services at Wellington Airport).
- In consumption efficiency of airlines services (that is, additional passengers using airline services at Wellington Airport).
- Dynamic efficiency.
- In competition.
- In distribution equity.

2.3 Increasing production efficiency

2.3.1 Short-haul loads

Estimates of the magnitude of “short-haul” savings as a result of removing constraints on the loads that can be carried by aircraft type and route are set out in Table 5 below. The Pacific route using the 737-800 is the only route to face a penalty taking off and landing. Calculating the full economic cost of such restrictions relies on estimates of the frequency with which flights are unable to take-off or land (or both) and the availability of the additional payload (i.e. the average seat factor and the extent to which airlines have restrictions in their reservation system). In addition, knowledge of the actual ticket yield (net of additional fuel costs, ticketing and ground handling costs) is required. The figures below are based on indicative average yields per passenger per sector.

Table 5 “Short-haul” load carrying capacity potential savings (\$NZ)

Aircraft	Sector	Direction	Estimated saving per flight
737-800	Domestic to WLG	Landing in wet	\$536
737-800	SYD/MEL/BNE to WLG	Landing	\$925
737-800	WLG to RAR/APW	Take-off	\$315
737-800	RAR/APW to WLG	Landing	\$1,124
A330-200	SYD/MEL/BNE to WLG	Landing in wet	\$6,825

Source: Astral Aviation Consultants (2015)²⁸

2.3.2 Long-haul loads

Astral Aviation Consultants indicate that while it is currently technically possible for a range of “wide-bodied” aircraft to take-off and land at Wellington Airport, the payload restrictions to allow such movements mean that it is not commercially viable for airlines.²⁹ Astral undertook analysis on the extent to which extending the runway by 355 metres to the south would allow “wide-bodied” aircraft to carry full passenger loads. The summary table below highlights the findings. A range of routes and aircraft types will be able to land at Wellington with a full payload, while there may still be some outbound restrictions for some routes and aircraft.³⁰

²⁸ Astral Aviation Consultants (2015a) “Wellington International Airport Proposed Runway Extension Aircraft Performance Benefits.”

²⁹ Astral Aviation Consultants personal communication via email.

³⁰ Astral Aviation Consultants (2015b) “Wellington International Airport- Review of Proposed Runway Extension Lengths- Updated report.”

Figure 2 Runway Extension Aircraft Capability

Aircraft	ROUTE				
	WLG-SIN	WLG-CAN	WLG-PEK	WLG-LAX	XXX-WLG
355m extended runway					
777-200ER	✓✓	✓	✗	✗	✓✓
787-8 (B64)	✗	✗	✗	✗	✓✓
787-8 (B70)	✓✓	✓✓	✗	✓	✓✓
787-9 (B74)	✓✓	✓✓	✗	✓	✓✓
A330-200	✓✓	✗	✗	✗	✓✓
A330-800NEO	✓✓	✓✓	✗	✓✓	✓✓
A330-900NEO	✓	✗	✗	✗	✓✓
A350-900	✓✓	✓✓	✓	✓	✓
A350-1000	✓	✗	✗	✗	✓✓
	WLG-CNS	WLG-ADL	WLG-RAR	WLG-APW	XXX-WLG
A320	✓	✓	✓	✓	✓✓
A320NEO	✓✓	✓✓	✓✓	✓✓	✓✓
A321NEO	✓✓	✓✓	✓✓	✓✓	✓✓

✓ Operation possible with a full passenger load under study conditions with dry runway
 ✓✓ Operation possible with a full passenger load under study conditions with wet or dry runway
 ✗ Operation not possible with full passenger payload under study conditions on dry runway
 ✓ Runway 16 or 34 wet runway landing can be made with a full passenger load
 ✓✓ Runway 16 or 34 wet runway landing can be made with a full payload

2.3.3 Reducing the cost of supplying airline services at Wellington Airport

By reducing the technical efficiency with which airline services can be supplied at Wellington Airport, the restricted length of the current runway increases the costs of operating aircraft at Wellington Airport. These operating costs include the costs of maintaining aircraft engines, wheels, brakes and tyres. Estimates of the extent to which the restricted length of the

runway at Wellington Airport increases the economic costs of supplying airline services at Wellington Airport are set out in the tables below.³¹

Table 6 presents estimates that the existing runway length imposes on take-off costs, ranging from around \$43 to \$53 per flight for existing “short-haul” services. These costs arise as a result of “flexible take-off thrust” procedures used by most airlines, which essentially means only using as much thrust as required “on the day.” The thrust required depends on surplus take-off weight available (i.e. any difference between the actual aircraft take-off weight and the limiting take-off weight given the runway length and ambient weather).

For a given payload, the runway extension provides greater limiting weight, which means lower thrust settings can be used. Lower thrust settings reduce the heat in the engines (particularly turbine blades), which in turn significantly reduce wear and tear. Actual annual total savings depend on the frequency with which planes are able to exploit the greater limiting weight (i.e. airlines might choose to increase the payload) and thus not use the lower thrust setting, meaning there is a payload gain but no secondary wear and tear benefit. Limited data is available, but a representative figure of 50 per cent was suggested by Astral Aviation Consultants who possess specialised knowledge on aircraft performance.

Table 6 Estimated Engine Maintenance Cost Savings (\$NZ)

Aircraft	Sector(s)	Maintenance cost savings per takeoff	Indicative savings per flight
A320/737;A320NEO/737MAX	WLG to domestic NZ	6 per cent	\$42.53
A320/737;A320NEO/737MAX	WLG to SYD/MEL/BNE	6 per cent	\$44.29
A320/737;A320NEO/737MAX	WLG to RAR/APW	7 per cent	\$53.28
A330-200	WLG to SYD/MEL/BNE	9 per cent	\$341.93

Source: Astral Aviation Consultants (2015)

Table 7 provides estimates of the cost impost on wheels, tyres and brakes from the existing runway length, ranging from \$45 to \$63 per flight. On a longer runway braking force can be reduced to slow the aircraft more gradually, taking advantage of the greater stopping distance available. This applies to all sectors flown by the aircraft shown. There will be occasions when pilots would choose to stop more quickly (e.g. where aircraft are following relatively closely), but the expert advice is that this would not occur often.

³¹ Note however, that some of the avoided cost benefits from the runway extension would be offset by increased fuel costs as a result of the greater taxi distances, and the fact that reduced thrust take-offs use slightly more fuel than take-offs at higher thrust. These are dealt with in the cost and benefit estimations further on in the report.

Table 7 Estimated Wheels, Tyres and Brakes Wear and Tear

Aircraft	Deceleration reduction	Wear and tear savings	Landings with savings	Indicative savings per flight
A320/737-800	19 per cent	10 per cent	90 per cent	\$45
A320NEO/737MAX	19 per cent	10 per cent	90 per cent	\$45
A330-200	14 per cent	7 per cent	90 per cent	\$63

Source: Astral Aviation Consultants (2015)

2.4 Increasing consumption efficiency

In addition to improving the efficiency with which airport and airline services are supplied, the proposed runway extension is also intended to improve the efficiency with which those services are used by:

- Reducing the generalised cost of airline services at Wellington Airport to both passengers and airfreight users, and
- Increasing the efficiency with which airline services are used.

2.4.1 Reducing the “generalised cost” of airline services to users

By reducing the technical efficiency with which aircraft can operate at Wellington Airport, the restricted length of the runway increases the “generalised costs” that passengers and airfreight users have to incur when they use airline services at Wellington Airport. These additional “generalised costs” of travel include:

- Higher airfares and airfreight charges users have to pay to compensate airlines for the higher costs of supplying airline services at Wellington Airport (e.g. the inability to use bigger, more efficient aircraft).
- Additional airfares and airfreight charges that passengers and airfreight users have to incur when travelling on “long-haul” routes to and from Wellington as a result of the need to travel on additional “link flights” between Wellington Airport and another international airport in New Zealand (e.g. Auckland or Christchurch) or Australia (e.g. Sydney, Brisbane or Melbourne).
- The opportunity cost of the additional time that passengers and airfreight users have to spend travelling and waiting at airports for link flights when travelling.

The proposed runway extension is expected to reduce these generalised costs of air transport for both passengers and airfreight users particularly by facilitating the provision of direct “long-haul” flights between Wellington Airport, Asia and the USA.

2.4.2 Increasing efficient use of airline services at Wellington Airport

By increasing the generalised cost of airline transport for both passengers and airfreight users, the restricted length of the current runway at Wellington Airport:

- Reduces the use of Wellington Airport by aircraft, passengers and airfreight users (i.e. it decreases the demand for airline services at Wellington Airport).
- Alters the pattern of airline use in relation to what it would be in the presence of a longer runway (i.e. the “wide-bodied” aircraft referred to earlier are not in the possible “menu” of aircraft choices for passengers and airfreight users).

The magnitude of increases in the level, and changes in the pattern, of demand for airline services at Wellington Airport from extending the runway will depend upon the:

- Extent to which the current cost of using airline services at Wellington Airport is increased by the restricted length of the runway, and
- Sensitivity of the demand for airline services at Wellington Airport to changes in the cost of airline transport.

The InterVISTAS forecasts on changes in passenger and flights are discussed in Section 3.

2.5 Increasing dynamic efficiency

The restricted length of the runway reduces the ability of WIAL and airlines operating at Wellington Airport to adjust to changes in the economic environment. These changes include the demand for services, the cost of supplying those services, and changes in aircraft technology; that is, the restricted runway reduces the “dynamic” efficiency of both the market for airport and airline services at Wellington Airport.

Indeed, most of the production and consumption inefficiencies outlined above are the result of the current lack of flexibility of Wellington Airport to adjust to changes in aircraft technology over the last decade. The proposed runway extension should increase the ability of both Wellington Airport and the airlines operating at Wellington Airport to adjust to future changes in the economic environment.

2.6 External economic costs and benefits of an extended runway

Not all of the economic costs and benefits of the proposed runway extension would be incurred and derived by those involved in the supply and use of that extended runway (e.g. WIAL, airlines operating at Wellington Airport, passengers and freight forwarders). Some of the economic costs would be incurred by other sections of the community, including the individuals and businesses that reside in the neighbourhood surrounding Wellington Airport.

Similarly, some of the economic benefits arising from the proposed runway extension are likely to be derived by other sections of the community including:

- New Zealand businesses that would provide additional goods and services to international visitors.
- Current and potential future users of New Zealand's network of airports and airlines, even if they never actually use Wellington Airport in the future (i.e. "network effects" are present for airports).³²

These important external costs and benefits should be taken into account in an economic cost benefit analysis, even if they cannot all be quantified in dollar terms. We consider these effects in Section 5.

2.7 Competition gains

Extending the runway at the Wellington Airport has the potential to increase competition among airlines seeking to carry passengers to and from Wellington. Increases in competition would determine the extent to which airlines:

- Pass the benefits of cost and time savings through to consumers.
- Lower prices for existing services.

We consider each of these effects in turn.

2.7.1 Cost and time savings passed on to consumers

Standard economic theory finds that the extent to which a cost saving is passed on to consumers depends on the competitive pressure in the market.

If the market were perfectly competitive, then all of the cost saving to airlines from extending the runway would be passed on to consumers. In the theoretical text book market of perfect competition, prices are set to reflect marginal costs and any change in marginal cost is immediately and fully passed through in prices.

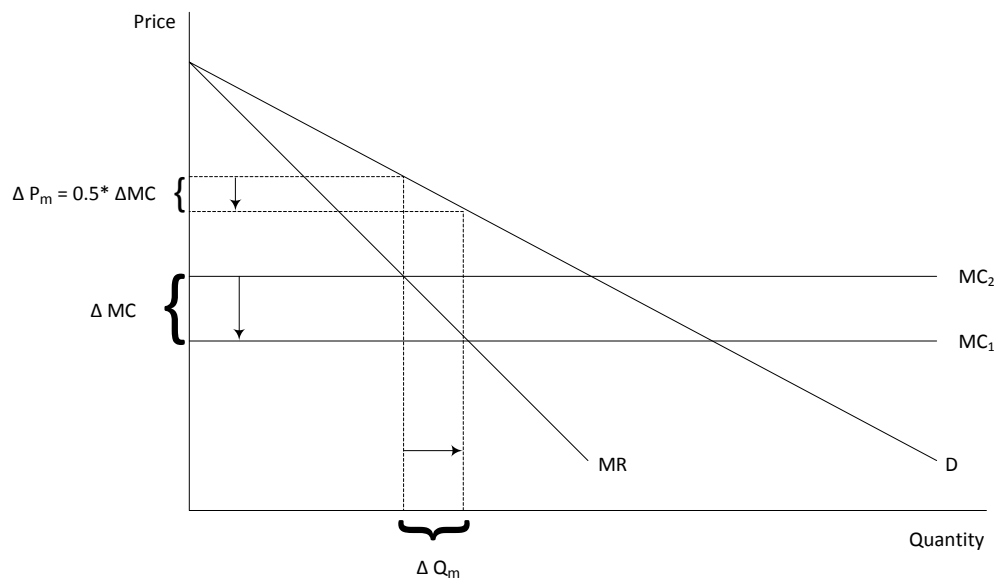
At the other end of the spectrum, if the air services market were supplied by a monopoly and passenger travel demand could be assumed to be represented by a linear demand curve, then the monopolist would pass through exactly half the change in cost. This is because the monopolist maximises its profits by setting its price where marginal cost (MC) is equal to marginal revenue (MR). Under an assumption that the demand curve is linear, the monopolist's marginal revenue curve is exactly twice as steep as the demand curve.³³

Hence, the profit maximising pass through for the monopolist is 50 per cent as shown in Figure 3 below. In practice, a monopolist's demand curve is unlikely to be linear and the exact proportion of pass-through will be determined by the shape of the demand curve.

³² Forsyth et al (2010) "Airport Competition: The European Experience" Ashgate page 384-385.

³³ To sell more, the monopolist must reduce its prices, hence the net additional revenue from the last unit sold is less than its average revenue on all units sold (this is a generalised concept; we discuss airline yield management below).

Figure 3 Cost pass-through by a downstream monopolist



Competition could therefore be expected to produce a level of pass-through of airline cost savings to consumers that is between the monopoly and perfectly competitive outcomes. Competition analysis in aviation markets is generally considered in terms of city-pairs. The reasoning behind this is that travellers, in most instances, have little flexibility in terms of their origination and destination. Hence, each aviation market typically comprises only a few firms – in economic terms, these markets are characterised as oligopolistic (i.e. dominated by a small number of suppliers).

An important determinant of outcomes in oligopolistic markets is the manner in which firms interact and compete for the market. The two cornerstone economic models for understanding this interaction are “Cournot” or quantity competition, and “Bertrand” or price competition. Under price competition, each firm sets price given its belief about how the other firms will price. Under Cournot competition, firms may behave as though they set quantities – perhaps the number of seats available at a given time - based on their knowledge of demand and the quantities they expect other firms to set.

In aviation markets, economists have found that the interaction between airlines appears often to be at least roughly consistent with Cournot behaviour. Airlines typically set capacity and then try to fill the seats by adjusting price through their yield management systems. The nature of pricing once capacities are established may reflect a range of considerations (some of which are discussed below). However there is theoretical support for the idea that capacity setting followed by price competition will lead to Cournot-type outcomes (see Kreps and Scheinkman, 1983).³⁴

³⁴ Kreps, D. and J. Scheinkman ‘Quantity precommitment and Bertrand competition yield Cournot outcomes’, Bell Journal of Economics, 1983, 326-337.

An oligopolistic market, under Cournot competition, produces a level of pass-through that is between the monopoly and perfectly competitive outcomes. A study often cited is Ten Kate and Niels (2005) which found that the price change in an oligopolistic market will be equal to $N/(N + 1)$ of the cost change, where N is the number of firms in the market. Hence, if there are two firms in the market the pass through would be 66 per cent.

2.7.2 Potential for additional price reductions from increased competition

In addition to the existing competitive pressure to pass through cost savings to consumers, the entry, or threat of entry, of new services following an expansion of the runway at Wellington Airport would place downward pressure on airline fares to and from Wellington.

The process by which airlines set prices for blocks of seats is known as “yield management” or “revenue management” and is the subject of significant research interest.³⁵ It appears that both price discrimination and demand uncertainty play an important role in determining airline pricing.

In markets such as air services where demand is uncertain and capacity is fixed in advance of demand, airlines seek to protect a certain number of seats for late booking, low fare elasticity traffic. Where competition is weak, airlines set higher prices (or, equivalently, allocate more seats to higher price levels) than would occur in a workably competitive market. The intuitive explanation is that a monopolist does not have to worry that a customer with a high willingness to pay might choose to fly with a competitor, if a cheaper fare is available. With increased competition, and hence the risk of losing the booking to a competitor, airlines would offer fare reductions that are not linked to the changes in costs.

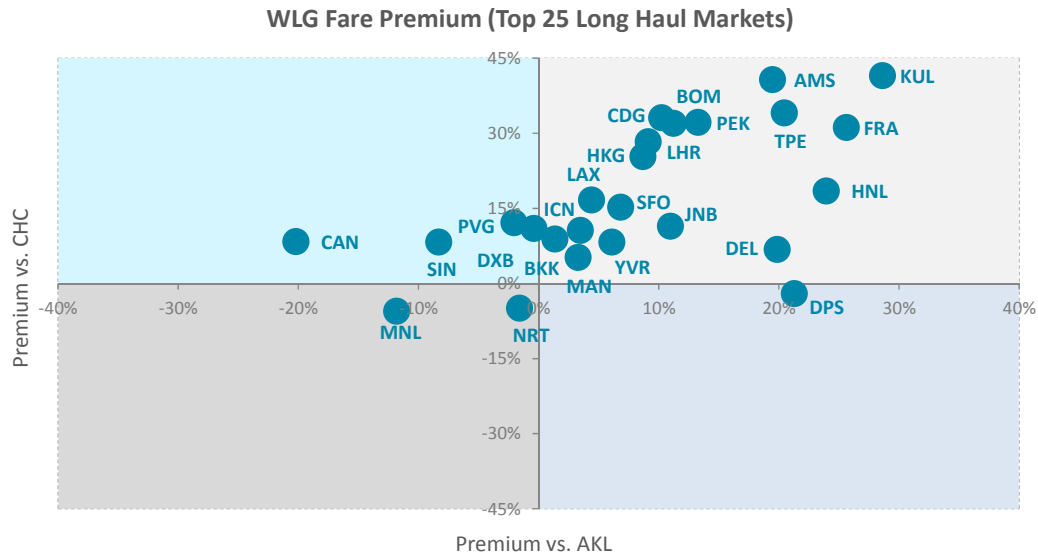
The scale of price changes from changes in competition in air services out of Wellington may be substantial. InterVISTAS, for example, compared the prices charged to passengers departing Wellington for 25 long-haul markets compared to prices charged to passengers departing Auckland and Christchurch.³⁶

The results of the InterVISTAS analysis are shown in Figure 4. Those routes located in the right hand top segment are routes for which fares are higher out of Wellington than out of Christchurch or Auckland. As the figure illustrates, fare premiums of about 20 per cent are not unusual, and some fare premiums exceed 30 per cent.

³⁵ See for example, Borenstein S., and Nancy L. Rose, ‘Competition and Price Dispersion in the U.S. Airline Industry’, *The Journal of Political Economy*, August 1994, pp 632-660; Dana, J.D., ‘Using yield management to shift demand when the peak time is unknown’, *RAND Journal of Economic* Vol. 30, No. 3, Autumn 1999, pp 456-474; and Dana, J.D. ‘Equilibrium price dispersion under demand uncertainty: the roles of costly capacity and market structure’, *RAND Journal of Economics*, Vol. 30, No. 4, Winter 1999, p 635.

³⁶ InterVISTAS, WLG Long Haul Viability, October 2015, page 25.

Figure 4 Fare premium if departing from Wellington compared to Christchurch and Auckland



The premiums identified in the InterVISTAS analysis would suggest that the competitive pressure of multiple carriers into Auckland and Christchurch may be muted by limited connecting services into Wellington. Long-haul services into Wellington would provide passengers a more convenient alternative to flying via Auckland or Christchurch for some routes; this increase in competitive rivalry could be expected to substantially reduce if not eliminate the price premiums identified by InterVISTAS.

2.8 Improving distributional equity

In addition to increasing economic efficiency, the proposed runway extension would improve distributional equity through improvements in the equity of access of both individuals and businesses in the Wellington region to:

- Affordable airline passenger transport services.
- Affordable airfreight services.

A major paper used around the world to evaluate air travel proposals provides some insights into air travel demand differences between higher income individuals (i.e. those from developed economies) and those with more modest income levels (i.e. those from developing economies). In particular, low income individuals are more responsive in their demand for air travel than higher income individuals, both at the market/route level and at the national level. For short-haul travel, the responsiveness for lower income people is at least a third higher than comparably richer travellers (see Table 8).

Inferring changes in air travel prices as implicit changes in income, there is some support for the proposition that cheaper air travel would result in a greater proportional change in the propensity to fly for those on lower incomes. To the extent that the runway extension results in cheaper air travel, we would expect that lower income individuals and families

would show a greater relative response (and hence achieve greater gains in utility) than more wealthy individuals and families.

Table 8 Estimated income elasticities

	Short-haul	Medium-haul	Long-haul	Very long-haul
Route/Market level				
Developed economies	1.5	1.6	1.7	2.4
Developing economies	2.0	2.0	2.2	2.7
National level				
Developed economies	1.3	1.4	1.5	2.2
Developing economies	1.8	1.8	2.0	2.5

Source: IATA (2008)

2.9 Achieving the desired outcomes of government

By improving economic efficiency and distributional equity, the proposed runway extension would help achieve the objectives for the:

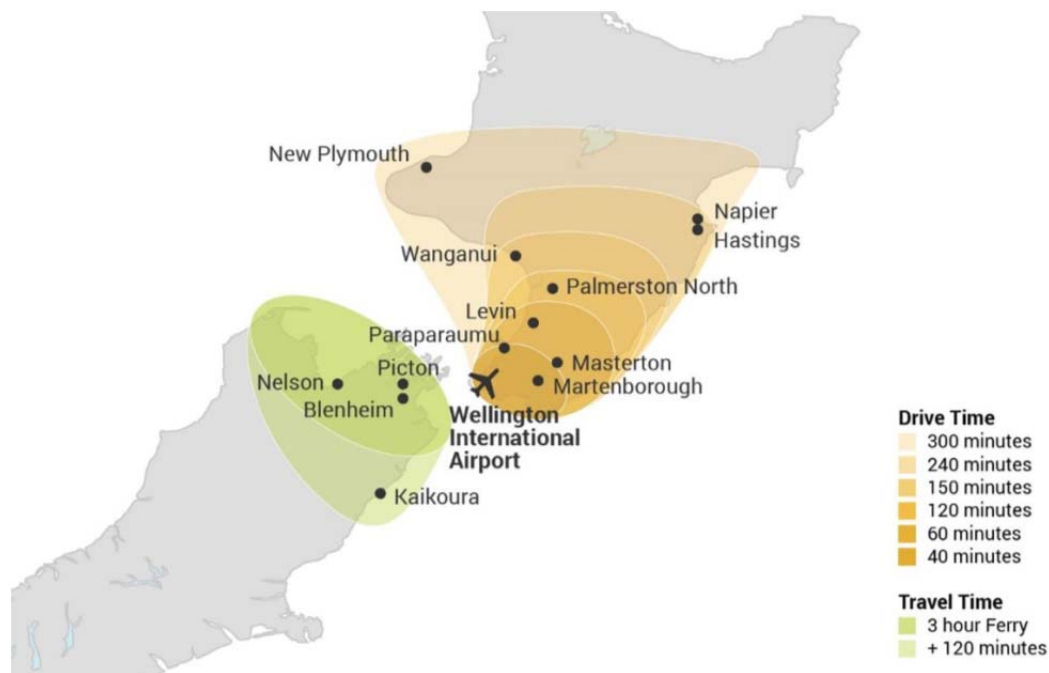
- Regional economic development and strategic visions of local authorities.
- New Zealand Government's *International Air Transport Policy*.
- Tourism sector's industry competitiveness plan (Tourism 2025).
- Leadership Statement for International Education.
- New Zealand Government's National Infrastructure Plan.

2.9.1 Airport supports activity throughout central region

An extended runway would support economic activity in the immediate Wellington area, and has the potential to contribute directly to economic activity across central New Zealand. Figure 5 is reproduced from a study by InterVISTAS.³⁷ It shows the radius of people currently using Wellington for trans-Tasman travel, and hence who might use or benefit from long-haul services out of Wellington Airport. The market for long-haul services from Wellington may draw from an area as far north as New Plymouth and as far south as the northern tip of the South Island – an area with an estimated population base of 1.1 million people.

³⁷ InterVISTAS, "Viability Assessment of Long Haul Service at Wellington Airport", December 2014, page 8.

Figure 5 Central region catchment area for international flights from Wellington



Source: InterVISTAS

InterVISTAS advised that the vast majority of travel would be drawn from the Wellington and Manawatu-Wanganui regions within a two hour drive of the airport, which generates 70 per cent of the catchment's long-haul demand.³⁸ For ease of reference, we refer to this catchment area as the 'Wellington region', although acknowledge the boundaries extend beyond what many people would consider encompassed by that language.

2.9.2 Wellington City Council's long term strategic vision and plans

The proposed runway extension would help the Wellington City Council achieve its long term strategic vision and plans for the national capital. The Council has developed an overarching long-term strategic vision for the city called *Wellington Towards 2040: Smart Capital*, which aims to grow and sustain the city as an inclusive place where talented people want to live.³⁹ That strategic vision is supported by four community outcomes or long term goals:

- **People-centred city.** Wellington's people are the city's greatest asset and its shape and character will continue to reflect the people who live in, work in, and visit the city. As a result, the strategic vision envisages the development of a People-centred City that is healthy, vibrant, affordable and resilient, with a strong sense of identity and 'place'

³⁸ Ibid, page 7.

³⁹ Wellington City Council, *Wellington Towards 2040: Smart Capital*, <http://wellington.govt.nz/your-council/structure-and-vision/vision-2040/towards-2040-smart-capital>

expressed through urban form, openness and accessibility for its existing and future population. This is intended to enable Wellington to compete for more people in the future, particularly the highly skilled, educated people who already make up a large proportion of Wellington's population.

- **Connected city.** Since Wellington is a small city in a small country, it needs to become a connected city – networked regionally, nationally and internationally – to attract flows of people, ideas and investment, and access larger domestic and off-shore economies. In particular, the strategy recognises the need for:
 - Improved physical connections by sea, air, rail, and road that allow for the ease of movement of people and goods.
 - Improved virtual connections in the form of a world-class ICT infrastructure.
 - Improved social connections to enable people to feel more connected with each other and their communities.
- **Eco-city.** To build on Wellington's current environmental strengths to transition to a low carbon future and achieve high standards of environmental performance, coupled with outstanding quality of life and an economy increasingly based on smart innovation.
- **Dynamic central city.** To foster the development of Wellington as a hub of creative enterprise that takes advantage of the universities, research organisations and creative businesses that are all clustered in or near the central city.

The Council's long term plan for achieving this strategic vision for Wellington, which is outlined in its *Long Term Plan 2015-25*⁴⁰, recognises that:

- Wellington's economic prosperity depends on the strength of its connections with the rest of the world.
- The lack of long-distance direct air connections reduces the region's ability to attract tourists, international students, support business growth and make business connections.

In addition, the recently completed Manawatu-Whanganui Regional Growth Study identified a range of initiatives designed to grow investment, incomes and employment in the region. These include tourism and manuka honey.⁴¹ Both of these are export-oriented undertakings that could reasonably expect to benefit from the proposed runway extension, in terms of connectivity, access, and efficiency.

While not able to be quantified in this analysis, there is both theoretical and practical support for the proposition that air links (in particular direct routes) provide a range of wider economic benefits outside of visitor expenditure. These benefits are particularly relevant to parties concerned with the growth of Wellington, but also from a New Zealand Inc. perspective as well.

⁴⁰ Wellington City Council, *Wellington City Council's Long Term Plan 2015-2025*, <http://www.our10yearplan.co.nz/assets/Uploads/files/2015-25-longtermplanvolume1.pdf>

⁴¹ <http://www.horizons.govt.nz/about-us/who-what-where/news/region-welcomes-growth-study-findings>

The main stream of benefits relates to investment and migration. The identified benefits include:⁴²

- Attracting new inward investment.
- Retaining existing companies.
- Higher inward migration, especially of skilled people.
- Promoting the export success of companies located in the area.
- Enhancing competitiveness of the economy.
- Adding to the quality of life of citizens.

Studies by the Air Transport Action Group (ATAG) found that labour mobility is significantly enhanced by air transport links and that such air links improve the ability of companies to attract highly skilled employees, particularly senior staff and professionals.⁴³ Air transport links allow migrants to travel home and friends and families of migrants are more able to visit them. It is well known that a strong and settled labour force is a key driver of economic performance, regardless of the jurisdiction.

The attraction of connectivity applies also to businesses, which look to exploit the benefits of both density (urbanisation) and localisation (industry) economies of agglomeration that transport links provide. Agglomeration factors are well known to be important to the economic performance of a region or country.⁴⁴ A major explanatory factor in agglomeration increasing productivity is the exchange of information, both explicitly and tacitly. Deep and skilled labour market effects are also important.

The link between the quality of airport facilities and urban economic growth has had some attention. Studies have found the existence of a very significant relationship between employment in high-technology industries and the availability of a large airport across US metropolitan areas. In addition, it was found that a good endowment of airport facilities fosters intercity agglomeration economies and influences the location decision of firms.

A study by Bel and Fageda sought to examine the role that direct (intercontinental) air links play in the location choice of firms' headquarters in Europe.⁴⁵ Controlling for other factors thought to influence location decisions (e.g. the proximity to large markets and specialised providers, congestion and tax costs, the availability of skilled labour, and the role of the urban area in the home country), they found that the availability of direct non-stop flights has a large influence on headquarters' location. A 10 per cent increase in intercontinental flights leads to around a 4 per cent increase in the number of headquarters of large firms located in the corresponding urban area.

⁴² Airbiz and BERL (2012) *"Economic Impact of a Wellington Long Haul Route."* Report to Positively Wellington Tourism.

⁴³ ATAG (2012) *"Aviation: Benefits Beyond Borders."*; and (2005) *"Air transport drives economic and social progress"* cited in Airbiz and BERL (2012).

⁴⁴ Treasury (2003) *"Agglomeration Economies and Economic Growth."* Working Paper 03/03, June.

⁴⁵ Bel G and X Fageda (2012) *"Getting there fast: globalization, intercontinental flights and location of headquarters."* Journal of Economic Geography (8), pp.471-495.

The significance of headquarters in the study is that headquarters typically involve significant communications burdens. They conclude that their results provide empirical confirmation of the importance of transport infrastructures and tacit information for the location of firms. In closing, the authors claim (at p.492):

Regional policies aimed at attracting headquarters of large firms (and other knowledge-intensive activities) must promote the development of international airports. In particular, investments to expand and/or improve their capacity and possibly the implementation of commercial strategies to attract major airlines are critical factors for the success of these policies.

While there are obvious differences between the size of firms in European cities and the respective pools of proximate labour, there is strong support for the notion that direct air links are a factor in firm location decisions and that tacit information exchange across cities is important in the context of globalisation. This is a further plank in building the “connectivity is king” story considered by The Treasury in a paper on international connections and productivity⁴⁶ and would conceivably add to the benefits of the runway extension that have been estimated in this analysis.

The proposed runway extension is also intended to facilitate other key initiatives of the Council to stimulate economic growth, and strengthen the economic resilience, in the Wellington region, including the:

- Expansion of the Wellington Museum to enable it to show more of its collection and attract more visitors.
- Development of a world-class film museum to recognise a major and highly successful local industry thereby raising the city’s profile, attracting more tourists, and having them stay longer.
- Construction of bigger conference and concert facilities in the central city.
- Creation of a tech precinct in the CBD to provide opportunities to foster growth in high-tech companies and encourage connections between creative people, business people, investors and the education sector.
- Development of a world-class ocean exploration centre at the Maranui Quarry site in Lyall Bay, providing opportunities to discover Wellington’s marine life and ocean environment.
- Development of a Museum of War and Peace adjacent to the Pukeahu Memorial Park.

2.9.3 NZ Government’s International Air Transport Policy

The proposed runway extension would help the New Zealand Government achieve its *International Air Transport Policy*. This policy seeks to increase economic growth and deliver greater prosperity, security and opportunities for New Zealanders by seeking opportunities for New Zealand-based and foreign airlines to provide their customers with improved

⁴⁶ New Zealand Treasury, *International connections and productivity: Making globalisation work for New Zealand*, (Productivity Paper 09/01), April 2009. <http://www.treasury.govt.nz/publications/research-policy/tprrp/09-01>

connectivity to the rest of the world, and to facilitate increased trade in goods and services (including tourism).⁴⁷

This *International Air Transport Policy*:

- Recognises that New Zealand's small population and relative isolation from its major trading partners are significant competitive disadvantages in terms of our ability to attract and secure new air services.
- Reaffirms New Zealand's desire to pursue greater liberalisation in international air services, providing freer access for international airlines.
- Recognises that a liberal air services policy, which seeks to remove regulatory constraints on air services, is a necessary tool to help ensure that the best possible social and economic outcomes are delivered to the benefit of all New Zealanders.

The New Zealand Government is pursuing this policy through:

- Reciprocal open skies agreements, except where it is not in the best interests of the country as a whole. Such Air Services Agreements typically provide for:
 - No restrictions on routes, capacity or traffic rights (including 7th freedom and cabotage - 8th and 9th freedom - rights).
 - No regulation of tariffs, except to prevent anti-competitive behaviour.
 - Liberal arrangements for granting operating authorisations following receipt of designation.
 - Provisions facilitating regulatory cooperation by civil aviation authorities on matters such as trade in aviation goods and services.
- In those cases where the other party will not agree to open skies agreements, through the most open package of air services arrangements that is in New Zealand's overall short and long term best interests. In so doing, the Government has indicated its intention to "...balance an exchange of sufficient capacity for services that airlines plan to offer in the short to medium term, with the long-term objective of open skies".

The proposed runway extension is intended to help the New Zealand government to achieve its international air transport policy objectives by:

- Providing additional opportunities for airlines to provide their customers in the Wellington region with improved connectivity to the rest of the world.
- Facilitating increased trade in goods and services, including tourism, between businesses in the Wellington region and the rest of the world.
- Reducing barriers to increased competition in both the markets for airport and airline services in the Wellington region.

⁴⁷ New Zealand International Air Transport Policy,
<http://www.transport.govt.nz/assets/Import/Documents/FINAL-Policy-Statement-International-Air-Transport-August-2012.pdf>

2.9.4 Supporting the Tourism 2025 targets

Tourism 2025 is a national initiative with the goal of improving the industry's competitiveness such that revenues will total \$41 billion by 2025. International tourism will need to grow 50 per cent faster than domestic tourism to achieve this goal (i.e. 6 per cent year-on-year versus 4 per cent year-on-year for domestic tourism).

One of the key planks in the planning framework to achieve this revenue goal is connectivity. In particular, growing sustainable air connectivity is slated as important due to its ability to “...strengthen relationships, partnerships and collaborations that sustain, expand and extend our visitor pipelines.”⁴⁸ Furthermore, Tourism 2025 claims one of its key findings is that direct, non-stop, services present the best opportunity for New Zealand to grow new and existing markets.⁴⁹

Tourism 2025 acknowledges that if airlines succeed, then the whole industry benefits and that collaboration is needed to support the air connectivity New Zealand currently has and the air connectivity needed, including internationally. One of the Tourism 2025 in Action foundation building examples is the Wellington Airport runway extension, in the context of the need for ongoing investment in aviation infrastructure and technology. In addition, the framework talks of growing active and focused industry support on targeted routes.⁵⁰

The proposed runway extension at Wellington Airport would support the Tourism 2025 goals by:

- Providing new, direct non-stop services, including to targeted areas in the Pacific Rim.
- Allowing growth in international visitation while not placing significant pressure on infrastructure.
- Creating opportunities to increase passenger volumes on existing services as well as improve the value of passenger mix, both identified as important in the framework.

2.9.5 Achieving national aims for international education

The Leadership Statement for International aims to double the value of international education to \$5 billion by 2025.⁵¹ The key to increasing the number of international enrolments is developing and sustaining mutually beneficial education relationships with key partner countries as a leading part of “New Zealand Inc.” strategies in Asia, the Pacific, the Middle East, Europe, and the Americas. The key routes that are feasible for direct air services from Wellington as a result of the runway extension are contained in this list.

In particular, the prospect of additional services from mainland China as a result of the runway extension would not only stimulate the market for visitors, but also the market for international students. A study for Education NZ in July 2013, cited in the economic impact

⁴⁸ Tourism 2025 Growing Value Together, Summary p.15.

⁴⁹ <http://tourism2025.org.nz/2025-in-depth/tourism-2025-strategic-themes/grow-sustainable-air-connectivity-2>

⁵⁰ Ibid.

⁵¹ <http://www.education.govt.nz/assets/Documents/Ministry/Strategies-and-policies/LeadershipStatementforinternationaleducation2011.pdf>

assessment of the runway extension by EY, indicated that Chinese generally have low awareness of New Zealand, especially as an education destination. Hence, any increased exposure for Wellington from stimulated tourist activity will likely flow through in a positive sense for Wellington as a study destination, especially for students of government and public policy.

In addition, one of the drivers of choice for international students is the accessibility of immigration. Migration choices are influenced by connectivity, and any advances in connectivity as a result of the runway extension would influence both migration choices (i.e. migrants tend to want to stay where they have been) and education, though most likely in the opposite order.

2.9.6 Meeting National Infrastructure Plan goals

The recently released National Infrastructure Plan has, as its vision, infrastructure in New Zealand that is resilient and coordinated and contributes to a strong economy and high living standards.⁵² The Plan claims that economic performance is strong with infrastructure that supports international connectedness, increased productivity, movement up the global value chain, and more exports and growth. The Plan also highlights the role of Asia in terms of growth opportunities, with attendant prospects for exports. Connectivity is important, both domestically and internationally.

Furthermore, resilient infrastructure requires a level of integration (both across infrastructure types and between regions), particularly in relation to transport. In particular, the Plan makes reference to three factors that would lead to a transport network that will support international connectedness and a strong export economy through:

- Continued negotiation of new air services agreements, both bilaterally and multilaterally, to provide more access to our key and future trade markets.
- The maintenance of the National Freight Demand Study to provide up-to-date forecasts to guide freight infrastructure investment and land-use planning decisions across the public and private sectors.
- The review of the Civil Aviation Act, which will improve the framework for regulating competition in international air services and allow the industry and government to be more responsive to technological changes.

The proposed runway extension has a relevance and potentially major contribution to make to all three of these factors.

⁵² <http://www.infrastructure.govt.nz/plan/2015/nip-aug15.pdf>

3. Forecast passenger traffic

3.1 Forecasts prepared for this analysis

This section summarises the forecasts of passenger traffic prepared specifically for this analysis.⁵³ A wide range of airport activity information was produced in terms of passenger traffic, aircraft movements and resulting additional services (i.e. routes) for both the “business as usual” case (i.e. what would happen in the absence of the runway extension) and for the runway extension case.

The forecasts cover domestic (both trunk and regional services) and international services. The forecasts cover the period 2015-2060, a relatively long period. Up until 2045, the forecasts are based on a fully developed model using a combination of econometric (driven largely off economic growth) analysis and Monte Carlo simulation. From 2045-2060, a simple extrapolation is used, with an assumed attenuation based on market maturity.

Beyond 30 years, it is much more difficult to capture effects of long term changes in:

- Consumer attitudes (e.g. climate change concerns impacting behaviour).
- General rate of economic growth (i.e. there are no meaningful economic forecasts past 2040).
- Changes in population birth rates (in a 10-20 year period, population forecasts are reasonably accurate. Beyond 20 years, the effects of potential changes in attitudes toward birth rates, immigration, etc. begin to affect the population level).
- Aircraft technology and fleet acquisition.

However, costs and benefits outside a thirty-year horizon generally do not materially influence the final results once these effects are discounted back to current dollars.

In addition, risk analysis was undertaken to examine the impact of multiple risk factors on the air traffic outlook and to determine the criteria for the high and low forecast outcomes. The risk analysis involved simulating 10,000 iterations of the “business as usual” forecasts of passenger traffic using different randomly generated sets of input factors. The median value generated by the 10,000 iterations was selected as the median (“most likely”) forecasts which are the main results reported below.

To generate low and high scenario forecasts, the 5th percentile and 95th percentile outcomes were selected as the criteria for each of those traffic scenarios. The low scenario implies that there is less than a 5 per cent chance that traffic at Wellington will drop below the low scenario forecast (or a 95 per cent chance that realised traffic will be above the low scenario forecast). Similarly, there is less than a 5 per cent chance that actual future traffic will exceed the high scenario forecast (or a 95 per cent chance that realised traffic will be less than the high scenario forecast).

⁵³ For a full description of the forecasts, see InterVISTAS (2016).

3.2 Market stimulation

The key to differences between the “business as usual” and runway extension cases is the extent to which routes and markets are stimulated by direct connections. More generally, market stimulation impacts underlying the forecast changes in passenger numbers and flight movements have been observed widely following the introduction of services. The evidence supports market stimulation effects that can be in the thousands of per cent for smaller markets.

The International Air Transport Association (IATA) has developed a “generic” market stimulation curve, based on actual stimulation data used by aviation industry participants to evaluate routes, infrastructure investment and the like. New demand for a route is calculated based on the existing number of passengers that take indirect flights to the destination. The stimulation effect estimated by the curve tends to be exponentially larger for smaller volumes of passengers at that particular airport for that potential direct route.⁵⁴

Market stimulation is not restricted solely to city-pair point-to-point situations. As shown in Figure 6 below, larger networks allow connections to smaller markets to be added. Adding a point-to-point service to Singapore from Wellington, for example, would open up an array of other markets. It is these hub effects that drive the changes in passenger and aircraft movement numbers we observe in the InterVISTAS forecasts, particularly for the USA (Los Angeles) and Other Asia (Singapore) forecasts.

Airlines route traffic through hubs to exploit density economies (i.e. the reduction in average costs resulting from increasing traffic at the route level). One factor important in raising passenger traffic is the attractiveness of the (hub) airport as a result of the greater number of possible destinations.⁵⁵

⁵⁴ Sismanidou A and J Tarradellas, G Beland, X Fageda (2013) “Estimating potential long-haul air passenger traffic in national networks containing two or more dominant cities.” *Journal of Transport Geography* 26 pp.108-116.

⁵⁵ Ibid.

Figure 6 Singapore Airlines Network

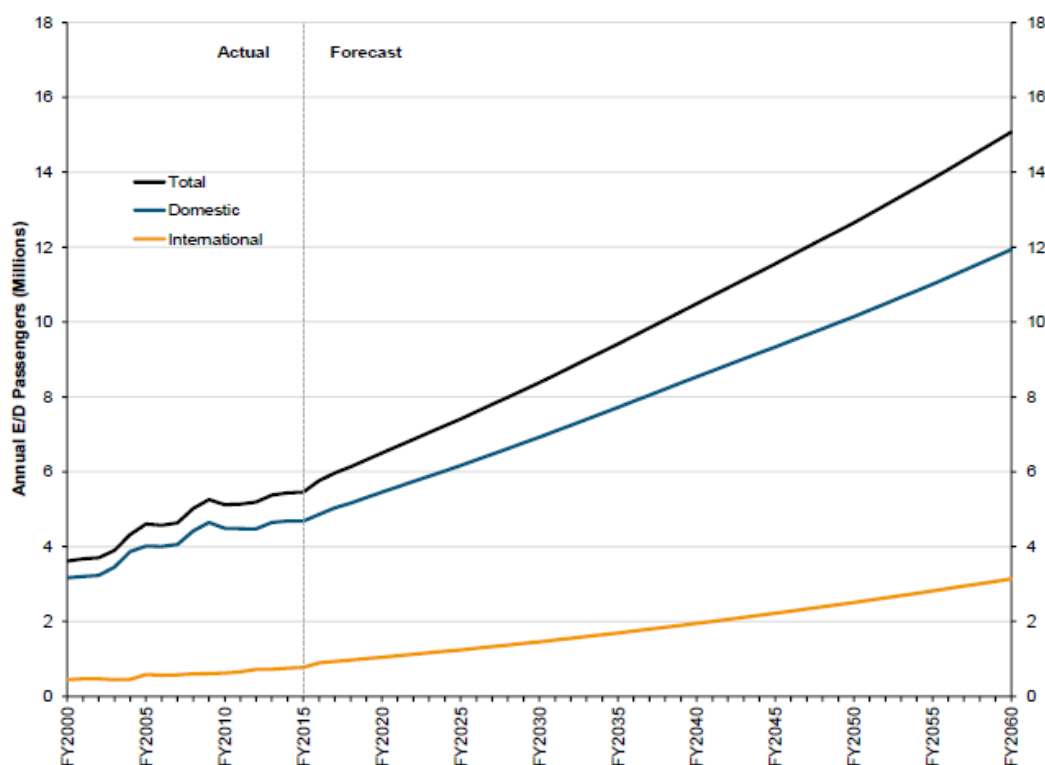


Source: InterVISTAS Consulting

3.3 Base case option (“business as usual”)

The “base case” option involves WIAL continuing to supply airport services without the benefit of a longer runway. Under this option, the median or “most likely” forecast sees total passenger traffic at Wellington Airport grow at an average annual rate of 2.3 per cent per annum to FY2060 reaching 9.4 million passengers in FY2035 and 15.1 million passengers in FY2060 (see Figure 7). In FY 2015, total passenger traffic was 5.5 million, and the annual average growth rate had been 2.8 per cent per annum in the FY1997-2015 period.

Figure 7 Annual passenger traffic – Business as Usual (millions)



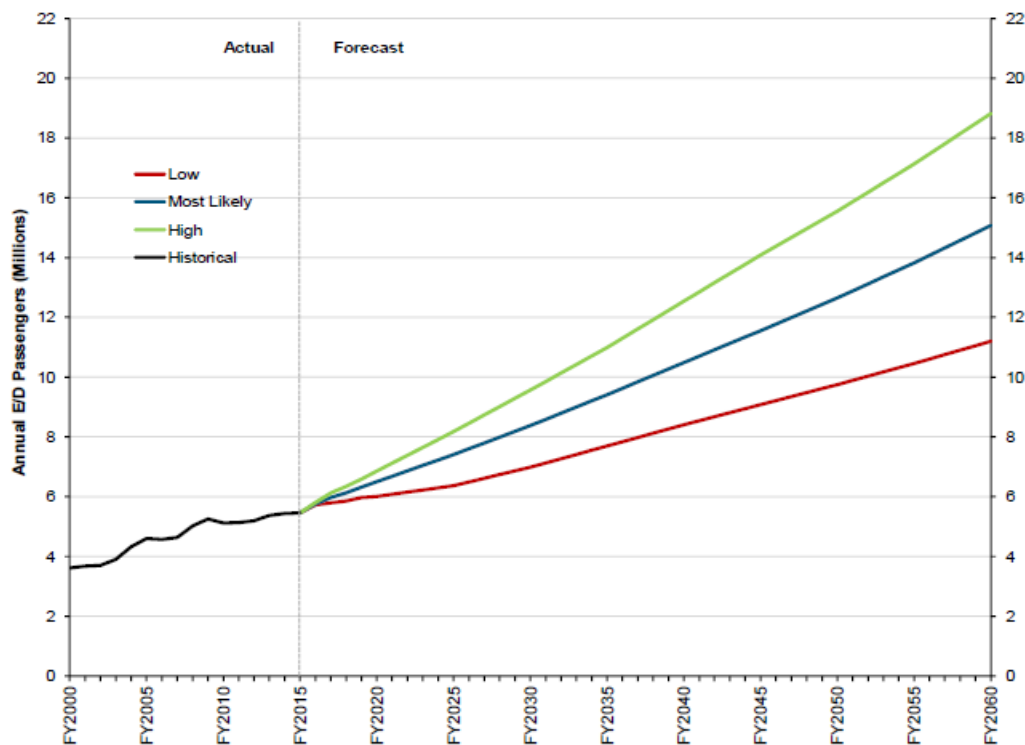
Source: InterVISTAS (2016)

Figure 8 shows the considerable range in total forecasted passenger numbers from the low (5th percentile, most likely), and high (95th percentile) scenarios. For example, in FY2035 the low and high scenarios for total traffic are 7.7 million and 11.0 million respectively, versus 9.4 million in the most likely case.

In the short term, the range of outcomes is skewed more to the downside. In the low scenario, the forecasts project the potential for well below historical growth levels. In the longer term, the spread between low and high forecasts is fairly balanced compared to the median/most likely forecast. Total traffic in the most likely scenario is forecast to grow at an average of 2.3 per cent per annum over the FY2015-FY2060 period, compared to 1.6 per cent per annum and 2.8 per cent in the low and high scenarios respectively.

International traffic (Australia and the Pacific under “business as usual”) is forecast to increase its share of total traffic from 14 per cent in FY2015 to 21 per cent in FY2060. This is reflected in the average annual growth rate for international being 3.1 per cent per annum (most likely) and 2.5 per cent and 3.6 per cent (low and high respectively) over the study period. Growth rates in the most likely scenario are projected to be highest in the coming 15 years, reflecting potential new services to Australia and capacity increases to the Pacific. That is, the bringing into service of A321, B737-MAX8 and A330 aircraft on Tasman routes (and A321 on Pacific) whereas at present the smaller A320 and B737 aircraft service these routes.

Figure 8 Range of passenger forecasts (millions)



Source: InterVISTAS (2016)

Annual aircraft movements are calculated by dividing passenger forecasts by estimated average passengers per aircraft movement, the latter defined as average aircraft size multiplied by an average load factor. Analysis of historical aircraft movements and load factors by sector, complimented by airline schedule data, was used to derive the forecasts.

Under “business as usual” aircraft movements are forecast to grow from 93,032 in FY2015 to 149,800 in FY2060. This represents an average growth rate of 1.1 per cent per annum. This growth rate is significantly lower than (i.e. less than half) the passenger movement equivalent due to aircraft upgauging and higher load factors over time. International movements are expected to grow faster than domestic movements for the same reason (see Figure 9).

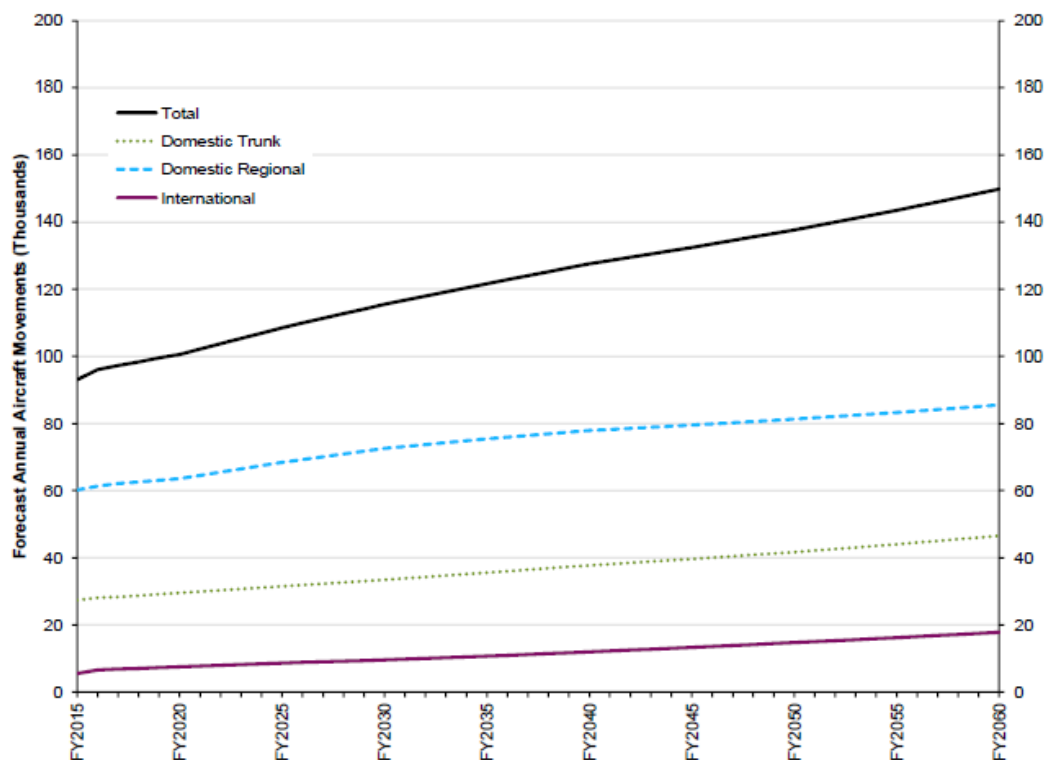
Domestic regional and international aircraft movements are expected to have significant short-term growth to accommodate additional scheduled capacity in those sectors by FY2017. In particular, on regional routes, movements are projected to increase by 12 per cent in FY2016 due in large part to the entry of Jetstar using a small fleet of Dash-8 300s.

Internationally, seat capacity and frequencies are expected in FY2016 for Australia, and the Pacific Islands are projected to more than triple the number of flights seen in FY2015, as Fiji Airways introduces year-round service to Nadi. International aircraft movements are projected to grow the fastest over the 45 year forecast period, at an average of 2.6 per cent per annum.

On the domestic side, trunk aircraft movements are forecast to grow at 1.2 per cent p.a. (vs. 2.1 per cent for trunk passengers) and regional movements at 0.8 per cent p.a. (vs. 2.0 per

cent for regional passengers). Regional aircraft movements are forecast to grow the slowest as that is the sector in which the greatest upgauging of aircraft is expected. By FY2060, it is forecast that regional aircraft movements will still make up the majority of aircraft activity at Wellington Airport, albeit with a lower share (57 per cent in FY2060 vs. 65 per cent in FY2015). Domestic trunk and international movements make up an increasingly large proportion of aircraft activity owing to the greater growth in passenger traffic on those sectors and more limited upgauging opportunities due to the constrained runway length.

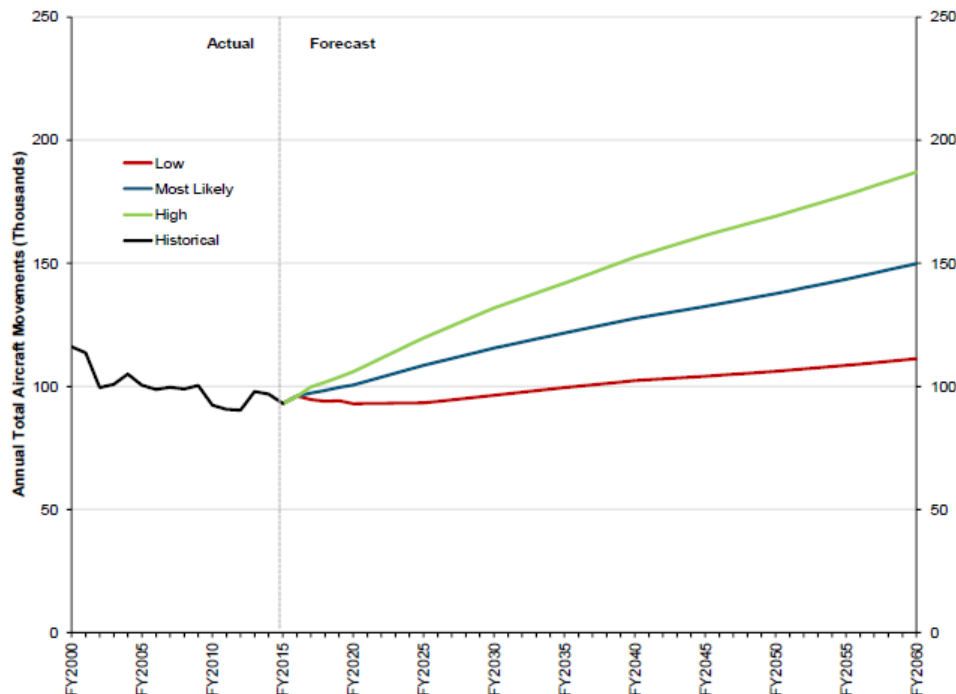
Figure 9 Forecast aircraft movements- Business as Usual (thousands)



Source: InterVISTAS (2016)

The range of forecast aircraft movements under “business as usual” is shown in Figure 10. Total aircraft movements under the high scenario are 187,000 by FY2060, while the low scenario forecasts just over 111,000 total movements. The most likely annual growth rate scenario is 1.1 per cent per annum from FY2015-FY2060; the low scenario results in annual average growth of just 0.4 per cent, while the high scenario shows growth of 1.6 per cent per annum. Like passenger numbers, growth in aircraft movements is highest in the first 15-20 years, before tapering off.

Figure 10 Range of forecast aircraft movements (thousands)



Source: InterVISTAS (2016)

3.4 Passenger forecasts if the runway is extended

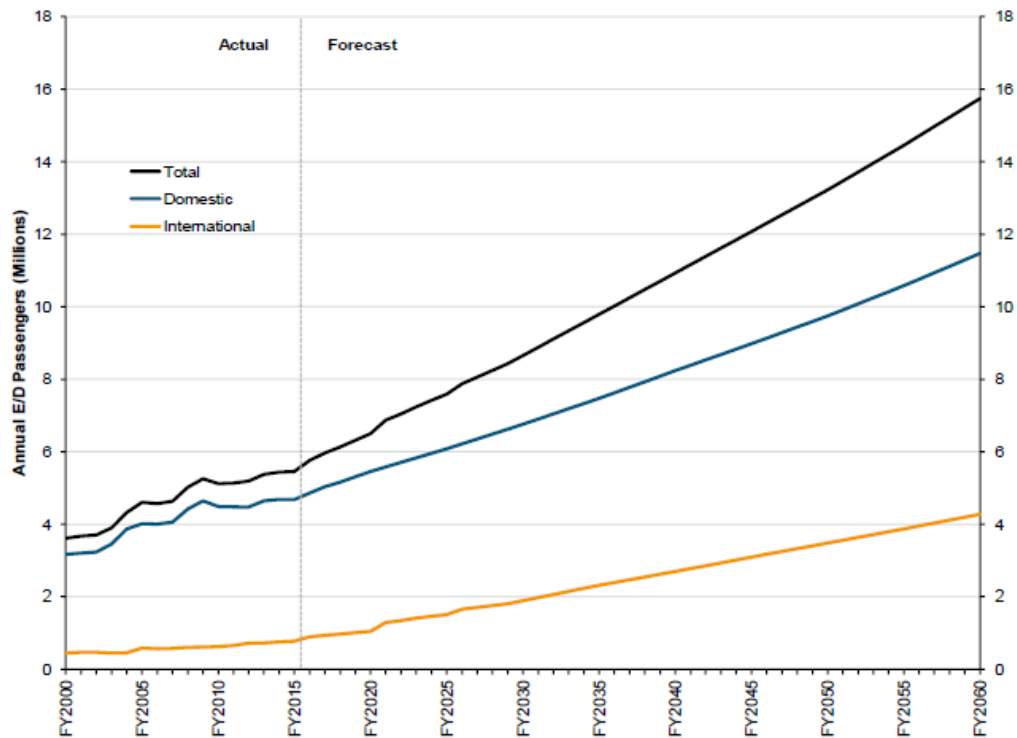
If the runway extension is in operation around April 2020, total passenger traffic would reach 15.8 million by FY 2060, growing at an annual average rate of 2.4 per cent per annum (see Figure 11). International traffic is the main driver of this change, growing at an annual average rate of 3.5 per cent per annum to reach almost 4.3 million in FY2060. This compares to average annual growth of 1.9 per cent per annum for domestic traffic, reaching almost 11.5 million in FY2060.

In the ten year period following construction of the proposed extension, international traffic is forecast to see its highest ever growth of 7.6 per cent per annum from FY2020-FY2025. Growth rates would then fall to about 5 per cent per annum through to FY2030, and would gradually revert to long-term average growth rates in the years following.

The forecasts of domestic air passenger traffic in the runway extension scenario are lower than the constrained “business as usual” forecasts. This difference is due to the reduction in domestic traffic as new long-haul international services are introduced as some passengers no longer need to make domestic (Auckland or Christchurch) connections to reach their overseas destinations. This loss of traffic is only slightly offset by the stimulation of new domestic connecting passengers travelling via Wellington to access the new long-haul international routes. In the most likely forecast of the runway extension scenario, domestic

air passenger traffic is approximately 461,000 passengers lower (applied to Auckland and Christchurch trunk routes) than the most likely forecast of the constrained “business as usual” scenario.

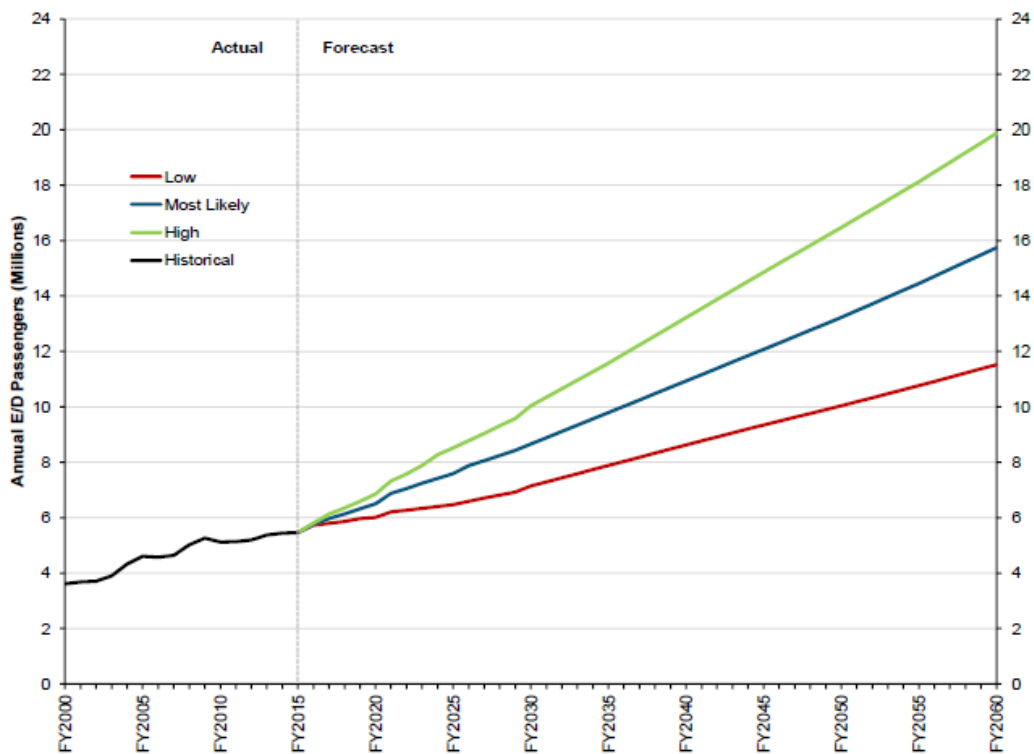
Figure 11 Annual passenger traffic - runway extension Option 1 (millions)



Source: InterVISTAS (2016)

Under the runway extension option, the forecast for passenger numbers ranges from around 11.5 million in the low scenario to 19.9 million in the high scenario (see Figure 12). The difference between the low and high forecasts relative to the most likely forecast under the runway extension is similar to the results of the “business as usual” runway-constrained forecast.

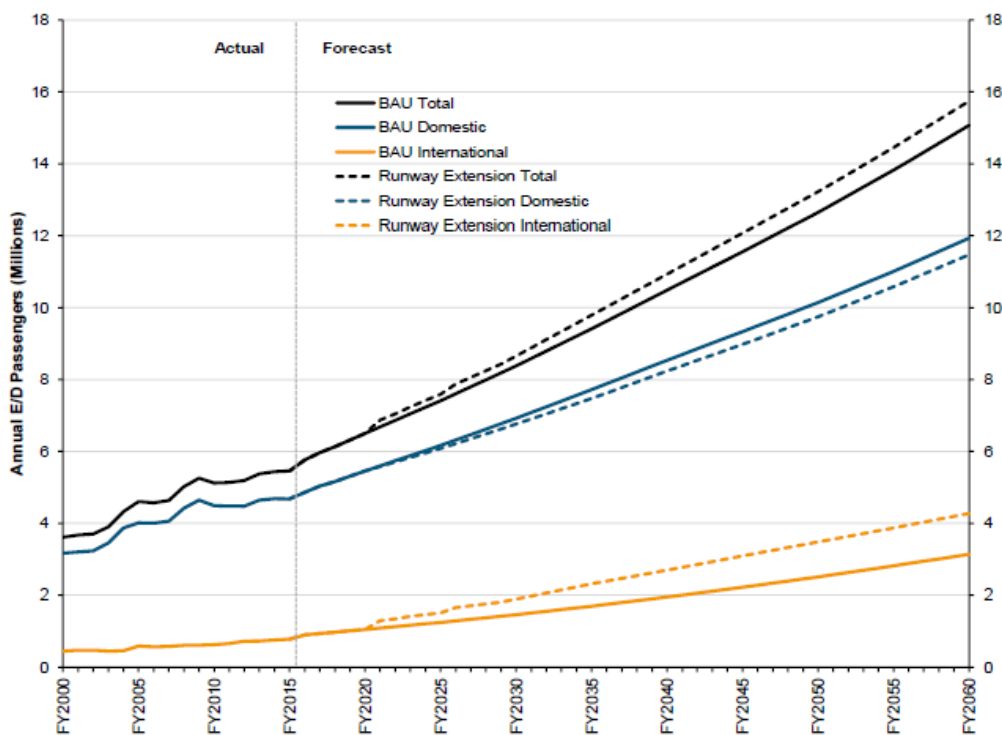
Figure 12 Range of passenger forecasts under runway extension Option 1 (millions)



Source: InterVISTAS (2015)

Figure 13 compares the most likely “business as usual” forecast of total passengers to the most likely forecast of total passengers with the runway extended. Compared to the “business as usual” forecast the runway extension scenario forecasts higher international and total air passenger volumes. Domestic air passenger traffic in the runway extension forecast is below that forecast in the business as usual scenario, as the introduction of new long-haul international services will reduce the number of passengers travelling domestically to connect at Auckland or Christchurch for overseas travel.

Figure 13 Comparison of runway extension Option 1 and “Business as Usual” most likely passenger forecast (millions)



Source: InterVISTAS (2015)

Annual total aircraft movements are forecast to reach 149,800 in FY2060, growing at an annual average rate of 1.1 per cent per annum. International movements are forecast to grow to 23,510 in FY2060 (from 5,520 in FY2015), growing at an average annual rate of 2.9 per cent per annum (see Figure 14). This results in a net increase of 5,700 international movements from the business as usual option. The key driver of this growth in international movements is the addition of new long-haul services following the runway extension, which are summarised in Table 9 below. InterVISTAS forecast these services after detailed examination of existing routes, and previous work for WIAL. They reflect the most likely scenario (high and low scenarios reflect more/less aggressive introduction of new services, respectively).⁵⁶

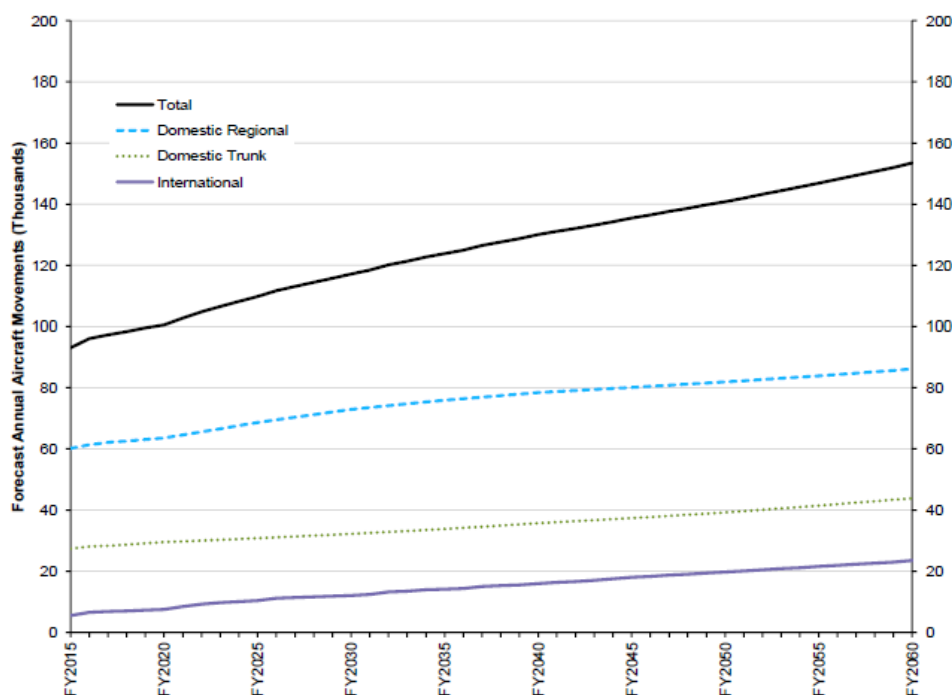
In addition to these new long-haul services, extra seat capacity has been included for existing services to Australia and the Pacific Islands to reflect the lifting of operational capacity (or weight penalty) restrictions as a result of the current runway length. Growth in load factors and frequencies are also assumed. The future development and expansion of long-haul capacity is captured by the following:

- Additional capacity on the originally planned route.
- New carriers entering the market on the same route.

⁵⁶ InterVISTAS (2014) “*Viability assessment of Long-Haul Service at Wellington Airport.*” Report to WIAL, December.

- New or existing carriers expanding service within the forecast region (e.g. services to Mainland China).

Figure 14 Annual aircraft movements - runway extension Option 1 (thousands)



Source: InterVISTAS (2016)

Table 9 Additional Long-haul Services - runway extension Option 1 most likely

Year of service introduction	E/D Forecast Region	Aircraft Type ⁵⁷	Initial Service Frequency
FY2021	Other Asia	B777	7xWeekly
FY2021	USA	B777	3xWeekly
FY2022	Australia	B777	4xWeekly
FY2026	China	A330	4xWeekly
FY2032	Other Asia	B777	4xWeekly
FY2029	Other Asia	B787	3xWeekly

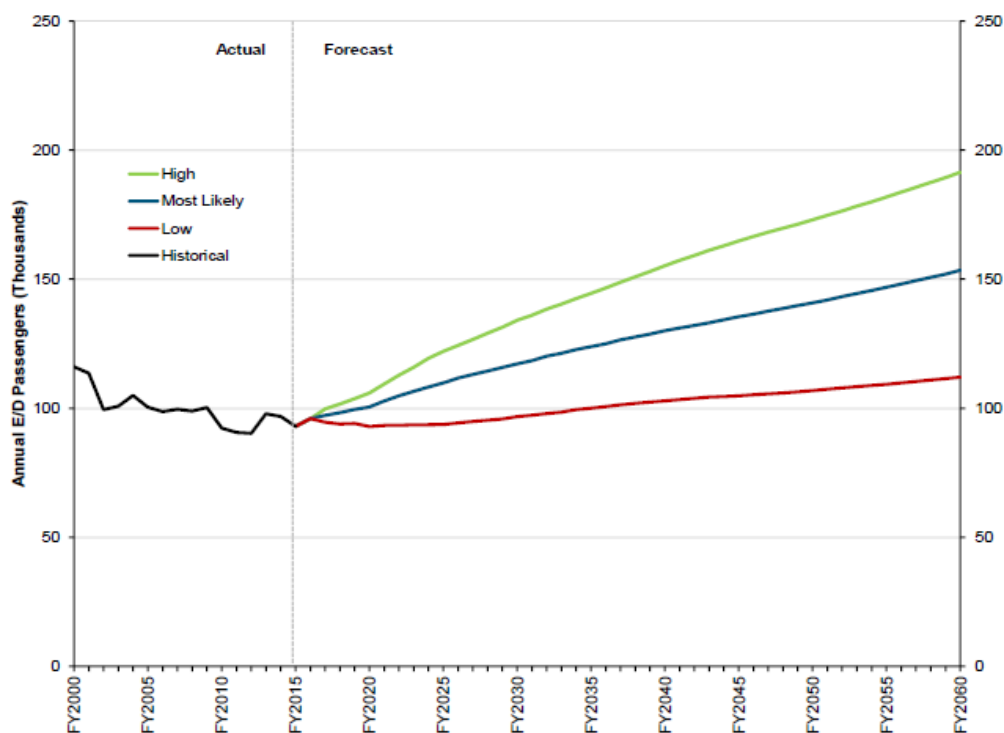
Source: InterVISTAS (2016)

⁵⁷ As discussed in the InterVISTAS report, these aircraft type projections are indicative of the size of the aircraft and not a specification of the actual model that would fly these routes.

The range of forecast aircraft movements if the runway is extended is shown in Figure 15. Compared to the constrained “business as usual” scenario, the low forecast is only 800 movements higher (112,400 vs 111,200 in the “business as usual” forecast). This small difference is largely dependent on the reduced deployment of new long-haul services in the runway scenario low forecast, leading to less diversion of existing domestic trunk and Australian passengers onto new long-haul routes. Comparing the two high forecasts, the runway extension scenario is 4,500 movements above the constrained business as usual forecast. The increased market stimulation featured in the international services in the high scenario (resulting in less cannibalisation of domestic trunk and Australia traffic) offsets the additional long-haul traffic leading to only small differences in the two high and low forecast results across scenarios.

Table 10 summarises the forecast change in total passenger numbers for the period 2015 to 2060, by scenario.

Figure 15 Range of annual aircraft movements- runway extension Option 1 (thousands)



Source: InterVISTAS (2016)

Table 10 Annual Passenger Growth Rates by Scenario (2015-2060)

Future	Market	Business as usual	Extended runway
Low	Domestic	1.4 per cent	1.3 per cent
	International	2.5 per cent	3.0 per cent
	Total	1.6 per cent	1.7 per cent
Most likely	Domestic	2.1 per cent	2.0 per cent
	International	3.2 per cent	3.9 per cent
	Total	2.3 per cent	2.4 per cent
High	Domestic	2.6 per cent	2.5 per cent
	International	3.7 per cent	4.5 per cent
	Total	2.8 per cent	2.9 per cent

Source: InterVISTAS (2016)

As outlined earlier, the “most likely” projections of 2.3 per cent in the business as usual, and 2.4 per cent with the runway extension scenarios are below the historical average (1997 – 2015) growth rate of 2.8 per cent.

4. Alternative options considered

4.1 Options previously considered

Over the course of this project a long list of alternative options for addressing the problems outlined in Section 2 have been identified and their feasibility explored. These options included the construction of a new airport at another location. The following range of possible locations was evaluated in terms of their feasibility, firstly in 1992 and then again in 2013:⁵⁸

- Wellington International Airport.
- Ohariu.
- Horokiwi.
- Mana Island (a).
- Mana Island (b).
- Paraparaumu.
- Te Horo.
- Wairarapa.
- Pencarrow.

The most recent study concluded that:

- The 1992 study addressed the critical aviation issues associated with each candidate site sufficiently to provide a good level of confidence that the current site is the optimal site for the airport.
- Although the potential influence of PANS-OPS (i.e. a set of imaginary surfaces determined by aircraft flight operations under instrument conditions that form an envelope over the existing obstacle environment and cannot be infringed in any circumstances) procedures was not addressed in the 1992 study, it was considered “very unlikely” that these factors would swing the preferred site away from the current site.
- Upon re-evaluation, most of the alternative sites are less practicable and less viable (i.e. there are accessibility, environmental, operational, and cost disadvantages relative to the existing site).
- There was significant current public commitment underway with investment in the state highway network in Wellington (the Roads of National Significance Northern Corridor projects) which in large part is in recognition of, and seeking to reinforce, the functionality of Wellington Airport at its current location as a ‘gateway’.
- The Consultant team viewed the airport on its current site as having latent aeronautical capacity, capability and surface access capacity for significant growth and improvement

⁵⁸ Works Consultancy Services Ltd (1992) *Alternative Airport Locations Study*; Airbiz, Beca and TGD (2013) *Alternative Sites and Methods*.

to runway capacity and airside and landside facilities to support a much greater passenger throughput, though to and beyond 2035.

In addition, a so-called “triangle service” has previously been considered.⁵⁹ This is a service that could, for instance fly Asia-Wellington-Christchurch-or-Auckland-Asia. This type of flight has some appeal to airlines, from the perspective of opening new connections that are not feasible with normal hub-spoke operations. In other words, such routing circumvents constraints such as a short runway.

However, analysis suggests that such an option would be costly (between \$5m and \$7m per annum for an airline, which would require an on-going subsidy to make the service viable and any other future services). In addition, such approaches add considerable complexity to scheduling/operations and revenue management, as well as effectively leaving half the required “solution” untouched (i.e. it might be very useful for Wellington Airport in terms of inbound traffic, but would not provide an outbound direct option and would be difficult for the other port to get value). Finally, not all “wide-bodied” aircraft are able to land on the existing runway, so full extent of benefit would not be realised.

4.2 Short list

The long list of options outlined above was reduced to the following short list for this CBA:

- “Base case” option, which involves Wellington Airport continuing to conduct business as usual without a longer runway (i.e. the “business as usual” option). This option serves the purpose of establishing a benchmark against which the “incremental” economic costs and benefits of the other options can be assessed.
- Option 1: Extend the runway, which would involve the construction of an extended runway from mid calendar year 2017 and the operation of that extended runway commencing from 1 April 2020.
- Option 2: Defer the extension of the runway, which would involve deferring the construction of the extended runway by ten years.
- Option 3: promote Wellington Airport as a tourist and airfreight hub, which would involve establishing a fund, equivalent in present value terms to the present value of capital expenditure under Option 1, to promote Wellington Airport as a tourist and airfreight hub each year over the period 1 April 2020 to 31 March 2060 (i.e. for a period of time that is the same as the expected useful life of the extended runway).

The base case and runway extension options (with construction commencing in 2017) have been described earlier. The following sections outline Options 2 and 3.

4.2.1 Option 2: Defer the runway extension

In view of the irreversibility of an extension of the runway at Wellington Airport, its potentially long economic life, and the uncertainty surrounding the potential economic costs

⁵⁹ InterVISTAS (2014) “*Costs and Considerations Involved with Multi-stop Routes.*” Report to Wellington International Airport Limited.

and benefits of that extended runway over that economic life, it is useful to consider whether the nation as a whole would derive a greater net benefit from deferring the construction and operation of the extended runway to a later date than would be the case under Option 1. This is essentially Option 2, which has all the same features of Option 1 but construction would be deferred until mid-2027 and the operation of the extended runway until 1 April 2030.

Consistent with the recommendations of the New Zealand Treasury's *Guide to Social Cost Benefit Analysis*, the option of deferring the construction of the extended runway has been set up as a separate option (i.e. Option 2) for evaluation.⁶⁰

By evaluating Option 2, and comparing the results of that analysis with those for Option 1, it is possible to identify both the:

- Potential economic benefits from deferring the construction and operation of the extended runway, which include:
 - A reduction in the present value of the estimated additional capital and operating costs that would have to be incurred by airports and airlines.
 - Maintaining the flexibility to leave the decision to as to whether to extend the runway, when to extend the runway, and by how much to extend the runway, until there is greater certainty surrounding the likely demand for long-haul air services and consequently the economic benefits that result from a runway extension (i.e. maintaining the “real option value” of that flexibility to defer those decisions until a later date when there may be less uncertainty regarding the economic costs and benefits of such a runway extension).
- Potential economic costs from deferring the construction and operation of the extended runway, which include:
 - A reduction in the present value of the estimated additional economic benefits that the nation as a whole would derive from extending the runway.
 - Foregoing the additional flexibility that an extended runway would provide (i.e. the “real option value” of the increased flexibility for the airport and airlines to meet unexpected future increases in demand or adjust to changes to technology and costs).

4.2.2 Option 3: Promote Wellington Airport as a tourist and airfreight hub

Unlike Option 1 and Option 2 which both seek to address the fundamental problems identified earlier, Option 3 would not involve an extension of the runway at Wellington Airport. Rather, Option 3 seeks to offset those problems by promoting the increased use of Wellington Airport as a tourist and airfreight hub.

⁶⁰ See section on “Real option values”, pp 28-30, New Zealand Treasury (2011).

To make Option 3 as comparable to Option 1 as possible in all other respects, it is assumed for the purposes of this report that the promotion of Wellington as a tourist and airfreight hub would:

- Require the nation as a whole to commit the same amount of capital expenditure at the outset of the project as would occur under Option 1 (e.g. by setting up a fund that would be used each year to promote Wellington as a destination, that cannot be reversed at a later date).
- Generate exactly the same increase in the level and pattern of demand for passenger travel as would the proposed runway extension.
- Achieve this forecast increase in demand through expenditure from the fund each year on the promotion of Wellington Airport as a tourist and airfreight hub.

By comparing the economic costs and benefits of Option 3 with Option 1, it is possible to illustrate the higher additional costs that the nation as a whole would have to incur if the existing runway facilities and narrow-bodied aircraft were used in an attempt to cater for the same increase in demand for airport and airline services that is forecast to occur under Option 1.

5. Evaluation of the options

This section presents our evaluation of the economic costs and benefits of the short list of options. In particular, we outline the:

- Economic costs of each of the alternative options (Section 5.1) – that is, the additional real value of the nation’s resources that would have to be used under each option relative to the base case.
- Economic benefits of each option (Section 5.2) – that is, the additional real value of outputs and other benefits that would be generated by each option relative to the base case.
- Net economic benefits of each option (Section 5.3) – that is, the net benefits that key stakeholders and the nation as a whole would derive under each option. This includes the:
 - Net benefits for airports, including WIAL and the operators of other airports in New Zealand.
 - Net benefits for airlines, including existing airlines operating at Wellington Airport and airlines not currently operating at Wellington Airport.
 - Net benefits for users of airline services, including existing passengers and users of airfreight services at Wellington Airport, as well as new users.
 - Net benefits for other sections of the community (i.e. those not directly involved in the supply or use of airport or airline services).
 - Total net benefits for the nation as a whole, which are equal to the sum of the net benefits outlined above after excluding any costs and transfers of wealth from one section of the community to another (e.g. from airport operators to airlines, or from airlines to consumers of airline services).

The economic costs and benefits of each of the alternative options are evaluated over the period 2015/16 to 2058/59, and expressed in present value terms using a real discount rate of 7 per cent.

5.1 Economic costs

The economic cost of each alternative option is equal to the real value of the nation’s resources that would be used as inputs under each option. These incremental economic costs include the:

- Incremental economic costs for airports – that is, the additional real value of the nation’s resources that WIAL and other airport operators in New Zealand would use to supply the increased quantity of airport services forecast under each option.
- Incremental economic costs for airlines – that is, the additional real value of the nation’s resources that airlines would use to supply the increased quantity of airline services forecast under each option.

- Incremental economic costs for users of airline services – that is, the additional real value of the nation’s resources that passengers and airfreight users would use if their demand for airline services was to increase as forecast under each option.
- Incremental economic costs for other sections of the community – that is, the additional real value of the nation’s resources that other sections of the community would use under each option.

5.1.1 Incremental economic costs for airports

The incremental economic costs to airports in New Zealand include the incremental real economic costs that:

- WIAL would incur under each option.
- Other airports would incur under each option.

Our estimate of these additional costs are set out in Table 11 and discussed further below:

Table 11 Incremental economic costs of each option for airports

ECONOMIC COST ITEM	OPTION 1 '\$000	OPTION 2 '\$000	OPTION 3 '\$000
Incremental economic costs for WIAL			
Increased capital costs			
• Cost of constructing extended runway	298,133	175,886	na
• Cost of additional Code E aircraft gates	7,450	3,787	na
<i>Total additional capital costs for WIAL (risk adjusted)</i>	<i>305,583</i>	<i>179,674</i>	<i>na</i>
Increased operating costs			
• Cost of supplying additional aircraft services	3,790	1,659	3,790
• Cost of supplying additional passenger services	19,714	8,488	19,714
• Risk of additional airport congestion	Minimal	Minimal	Greatest
<i>Total additional operating costs for WIAL</i>	<i>23,503</i>	<i>10,147</i>	<i>23,503</i>
Economic cost of losing flexibility to defer investment in the project	Highest	Second highest	Lowest
Total incremental economic costs for WIAL	329,086	189,821	23,503
Incremental economic costs for other New Zealand airports			
• Loss in value of airport services supplied due to flights diverted to WIA	14,781	6,234	14,781
• Cost of supplying additional airport services	2	1	2
Total incremental economic costs for other NZ airports	14,783	6,235	14,783
TOTAL INCREMENTAL ECONOMIC COSTS FOR NZ AIRPORTS	343,869	196,055	38,286

Incremental economic costs for WIAL

The incremental real economic costs for WIAL include both the increased real capital and real operating costs that WIAL would have to incur under each option.

Increased capital costs for WIAL

The increased real capital costs for WIAL of each option include the:

- Real value of capital that WIAL would use to provide the airport services required to meet the forecast increase in the number of flights and passengers travelling to and from Wellington Airport under each option. This includes constructing the extended

runway and additional gates to handle the increased numbers of wide-bodied aircraft using the airport over the period of analysis (i.e. “Code E aircraft gates”).

- Real returns that WIAL would have to make on those additional investments to compensate it for the costs of using that capital (i.e. the “user cost of capital”).⁶¹ This user cost of capital is taken into account in the analysis by the real discount rate that is used to express future capital costs incurred by airports in present value terms. This real discount rate takes into account both the:
 - “Return on investment” (i.e. “ROI”) that airports need to make to compensate them from not being able to invest in the next best alternative investment (i.e. to compensate them for the “opportunity cost” of that capital).
 - “Return of capital” (i.e. “ROC”) that is required to compensate WIAL for the real value of that capital that is “used up” over the life of that asset (i.e. to compensate it for the “economic depreciation” in the value of the asset, which arises as a result of factors such as physical wear and tear, as well as reductions in the economic value of the asset due to technological obsolescence – such as the inability of new, wide-bodied aircraft to use the runway).

As indicated in Table 11, it is estimated that:

- Option 1 would involve the highest incremental capital cost for WIAL of \$305.6m, expressed in present value terms (i.e. 2015/16 dollars). This estimate has been derived using:
 - Information provided by AECOM on the median, risk adjusted, nominal capital costs of constructing the extended runway, amounting to \$287.5 million. That nominal capital cost has been spread equally over the assumed three year construction period (i.e. 2017/18 to 2019/20) and indexed by the assumed annual increase in the real prices of capital assets (i.e. 1.5 per cent) to express those amounts in future real dollars of the day. Consistent with the treatment of all other future economic costs and benefits, those nominal dollar amounts have then been expressed in present value terms using the real discount rate (i.e. 7 per cent).
 - Information provided by WIAL on the capital cost of constructing the additional gates required when the number of additional wide-bodied aircraft that are forecast to arrive under each of the options exceeds three aircraft per day. The economic cost of each additional gate is estimated at \$10 million, expressed in 2012/2013 dollars. The timing of this capital expenditure is driven by the number of additional Code E aircraft forecast to use Wellington Airport under each option. Under the most likely scenario, Wellington Airport is expected to need two additional Code E gates over the second half of the period of analysis under Option 1 (the low scenario would require one further gate, while the high scenario would also require two, though much earlier in the analysis period).

⁶¹ For a detailed discussion of the estimation of both the pre and post tax user cost of capital, see Auerbach, A. J. (1982). *Taxation, Corporate Financial Policy, and the Cost of Capital*, National Bureau of Economic Research, Working Paper Number. 1026, November 1982. <http://www.nber.org/papers/w1026.pdf>. See also Jorgenson, D. W. (1963), “Capital Theory and Investment Behavior”, *American Economic Review*, May 1963, 53 (2), pp. 247—259. <https://www.aeaweb.org/aer/top20/53.2.247-259.pdf>

- Option 2 would involve the second highest incremental capital cost for WIAL of \$179.7m, expressed in present value terms, since it involves deferring the same amounts of capital expenditure as would occur under Option 1 until 2026/27.
- Option 3 would involve no additional capital costs for WIAL. However, as discussed further in Section 5.1.4, Option 3 would involve the government incurring an additional capital cost equal in value to that incurred by WIAL under Option 1.

Increased operating costs for WIAL

In addition to increased real capital costs, WIAL would also incur additional real operating costs each year to provide additional airport services to meet the forecast increase in demand for airline services under each option. These increased real operating costs for WIAL include the:

- Real value of the additional operating costs WIAL would incur to operate the extended runway and the passenger terminal facilities at the airport. The magnitude of these additional real operating costs have been estimated by:
 - Using InterVISTAS forecasts of the additional numbers of aircraft and passengers arriving at Wellington Airport under each option.
 - Multiplying those forecasts by the estimated operating costs that WIAL would incur to supply services to those additional aircraft and passengers. These additional operating costs have been estimated as being 24 per cent of the market value of those services.
- Any additional real economic costs that WIAL incurs as a result of additional aircraft using its runway during peak periods of demand (e.g. any incremental “congestion costs”). Since the forecast increases in the number of additional flights to and from Wellington Airport over the period of analysis are expected to occur outside peak hours of operation,⁶² we expect the additional congestion costs that WIAL would incur under Option 1 and Option 2 to be minimal. By contrast, under Option 3, there is a significant risk that Wellington Airport would experience an increase in congestion costs to the extent that the additional flights required to carry the forecast increase in passengers do not arrive outside peak periods of demand for the airport.

As indicated in Table 11, it is estimated that:

- Option 3 would involve operating costs of \$23.5m that are at least as high, and probably higher, than Option 1 and Option 2, to the extent that, in the absence of a longer runway, more aircraft movements may be required to transport the forecast increase in passengers using Wellington Airport.
- Option 1 would involve similar operating costs to Option 3 of \$23.5m, expressed in present value terms. However, the additional congestion costs are expected to be lower than Option 3 to the extent that the additional aircraft movements required to transport

⁶² The best indicator of the likely arrival and departure times of new long-haul routes to Wellington are the existing long-haul schedules to Christchurch and Auckland, and these predominantly arrive and depart outside of existing peak use of Wellington Airport.

the additional passengers that are forecast to use Wellington Airport under Option 1 occur outside peak airport operating hours.

- Option 2 would involve incremental operating costs for WIAL of \$10.1m, expressed in present value terms since it involves deferring the same amounts of additional operating expenditure as would occur under Option 1. Like Option 1, it would also involve minimal additional congestion costs to the extent that the forecast additional aircraft movements occur outside peak airport operating hours.

In addition to these incremental real operating costs incurred by WIAL, the nation as a whole will also incur additional incremental economic costs if the prices that WIAL charges airlines for the additional airport services it provides differ from the social marginal cost of supplying those services (i.e. if WIAL charges a price for those additional airport services that differs from its private marginal cost of supplying those services plus the additional marginal environmental cost of supplying those services). These additional “deadweight costs” are discussed further in Section 5.1.4 below.

Economic cost of losing the flexibility to defer investment in the project

As the investment decisions to extend the runway would be irreversible, and in any project there is uncertainty as to the economic costs and benefits of the investment decision, the flexibility to defer the decision has a real value to decision makers (i.e. it has a “real option” value). This option value would be lost if that flexibility was lost or reduced to some extent. In particular, under Option 1 and, to a lesser extent, Option 2, WIAL and regional and central government would lose current flexibility to indefinitely defer its decision as to whether or not, and how much, to invest in the construction of a longer runway. Specifically:

- Under Option 1, WIAL would start to lose that flexibility in 2016/17 when construction of the extended runway is assumed to commence.
- Under Option 2, WIAL would start to lose that flexibility in 2026/27, when construction of the extended runway is assumed to commence.

Similarly, under Option 3, the Government would lose the flexibility that it has to defer its investment in the promotion of Wellington Airport as a regional hub for international tourists and airfreight to the extent that it would be unable, for whatever reason, to reverse that decision for a certain period of time.

Unlike Option 1 and Option 2, however, it is likely that the government would have some scope under Option 3 to reverse its decision to continue investing in the promotion of Wellington Airport as a tourist and airfreight hub and at some future date could use the remaining balance of the funds for other purposes. We have allowed for these additional economic costs in the analysis through the use of a higher discount rate (i.e. 10 per cent) in the sensitivity analysis.

Incremental economic costs for other New Zealand airports

WIAL is not the only airport operator that would experience additional economic costs under each of the alternative options. Other operators of New Zealand airports would also incur additional economic costs under each of the alternative options to the extent that those options:

- Reduce the real value of the airport services that would otherwise have been supplied by some airports by diverting aircraft and passengers to Wellington Airport. The magnitude of this reduction in the real value of output of other airports in New Zealand under each of the alternative options has been estimated by:
 - Using InterVISTAS forecasts of the extent to which each of the options is expected to divert domestic trunk aircraft and passenger traffic to Wellington Airport.
 - Multiplying those forecast diversions in aircraft and passenger traffic by an estimate of the average market price that other airports in New Zealand would have charged for the services they would have supplied to those diverted domestic trunk and domestic regional flights.
- Increase the real value of output supplied by some other airports (e.g. regional airports providing connecting flights to Wellington Airport), thereby increasing the real capital and operating costs they have to incur to supply those additional airport services. The magnitude of this increase in resource use by other airports has been estimated by:
 - Using InterVISTAS forecasts of the extent to which each of the options is expected to increase the demand for regional airport services under each of the options.
 - Multiplying those forecast increases in aircraft and passenger traffic at those regional airports by an estimate of the operating costs they would incur to supply those additional services. Once again, these additional operating costs have been estimated as being 24 per cent of the market value of those services.

As indicated in Table 11, it is estimated that:

- Option 1 and Option 3 would involve the highest incremental economic costs for other airports of \$14.8m in present value terms.
- Option 2 would involve the second highest incremental economic costs for other airports of \$6.2m, expressed in present value terms, since it involves deferring the same amounts of economic costs as would occur under Option 1 and Option 3.

In addition to these incremental economic costs incurred by other airports in New Zealand, the nation as a whole would also incur incremental economic costs due to “deadweight costs” that can arise from the use of inefficient airport charges to fund these additional airport services.

5.1.2 Incremental economic costs for airlines in supplying the additional quantities of airline services under each option relative to the “base case”

As outlined in Table 12, we assume that the additional services, relative to the base case, would be supplied by foreign owned airlines. It is only the real value of New Zealand resources used by airlines to supply these additional airline services that are relevant for the purposes of this analysis. Any non-New Zealand real capital, labour, or other resources used by foreign airlines to supply the additional airline services do not represent an economic cost to New Zealand; rather, they would be a cost to the nation that owns those resources. As a

result, both the incremental economic costs and incremental economic benefits that these foreign owned airlines would incur and derive when supplying these additional airline services have been excluded from the analysis. This approach ensures that any net benefits derived by foreign airlines are excluded from the analysis.

Table 12 Incremental economic costs of each option for airlines

ECONOMIC COST ITEM	OPTION 1 \$'000	OPTION 2 \$'000	OPTION 3 \$'000
Incremental economic costs for airlines supplying additional services			
• Cost of supplying additional services to passengers	Assumed to be incurred by foreign airlines		
• Cost of supplying additional services to airfreight users	Assumed to be incurred by foreign airlines		
• Risk of increased congestion costs	Minimal	Minimal	Greatest
TOTAL INCREMENTAL ECONOMIC COSTS FOR AIRLINES	Assumed to be incurred by foreign airlines		

Incremental economic costs for airlines continuing to supply existing services at Wellington Airport

To transport passengers and freight over “long-haul” distances to and from the Wellington region, airlines use a range of real resources that represent not only a real economic cost to those airlines, but also to the nation as a whole. Under the “base case”, airlines transporting passengers and airfreight over “long-haul” distances to and from the Wellington region incur:

- Economic costs in supplying domestic airline services between Wellington Airport and the New Zealand international airport where the passengers and airfreight will embark on, or be disembarked from, the international airline leg of the journey.
- Economic costs in supplying the international airline services to transport passengers and freight between the international airport in New Zealand and an overseas international airport.
- Other economic costs in supplying those domestic and international airline services, which include:
 - Any congestion costs that airlines incur in supplying airline services during the peak periods of airport use.
 - Opportunity cost of any other resources that airlines use to travel long-haul distances to and from the Wellington region.

Each of the alternative options has the potential to both increase and reduce these economic costs.

Increased capital costs for airlines supplying existing services

We assume that none of the options would cause airlines to incur additional capital costs (e.g. the costs of purchasing or leasing additional aircraft) to meet the ‘base case’ forecasts over and above the costs they would have to incur in any event to meet those base case forecasts. Rather, as discussed further in Section 5.2.3 below, the extension of the runway under Option 1 or Option 2 has the potential to generate benefits for those airlines by reducing the capital costs of transporting the existing volumes of passengers and freight over existing routes (e.g. by allowing them to use more efficient, wider bodied, aircraft to transport existing passengers and airfreight travelling to and from Wellington on long-haul routes).

By contrast, under Option 3, airlines would not derive those benefits, since they would have to continue to use the existing aircraft operating at Wellington Airport to supply those existing airport services.

Increased operating costs for airlines supplying existing services

Although no option is likely to increase the real capital costs that airlines incur to provide existing passenger and airfreight services over existing routes, the options do have the potential to increase airline operating costs. In particular, by increasing the length of the runway, both Option 1 and Option 2 have the potential to increase the cost of the airport services that are used by airlines to provide both existing and additional airline services at Wellington Airport, unless they are more than offset by reductions in costs arising from economies of scale.

For the purposes of Sections 4 and 5 of this report, however, it is assumed for simplicity that:

- The additional financial capital and operating costs that WIAL would incur to construct the extended runway under Option 1 and 2 would be funded through general government taxation revenue, rather than through an increase in the prices that WIAL charges airlines for its airport services.
- WIAL would not need to increase its airport charges to recover the additional capital costs that it would incur under Option 1 and Option 2.

Indeed, as discussed further in Section 5.2.3, rather than increase operating costs for airlines supplying existing services, the extension of the runway under Option 1 or Option 2 has the potential to reduce those operating costs. This reduction would occur through the use of more efficient wide-bodied aircraft to transport existing “long-haul” passengers and freight travelling to and from Wellington Airport directly. Currently, narrow-bodied aircraft are used to carry those existing passengers and freight on the first short-haul leg of that journey (e.g. from Wellington Airport to either Auckland or Christchurch airports).

The simplifying assumptions outlined above regarding the funding of the proposed runway extension under Option 1 and Option 2 are then relaxed in Section 7.1 of this report. That section considers a range of alternative approaches to funding the proposed runway extension, as well as the implications that these alternative funding options have for the results of the cost benefit analysis.

The magnitude of the additional congestion costs incurred by airlines, under each option, in continuing to provide existing services at Wellington Airport will depend on the:

- Total number of additional flights forecast to occur at Wellington Airport under each option.
- Extent to which those additional flights occur within or outside the peak periods of demand for airport services at Wellington Airport. In general, the highest congestion costs for airlines continuing to supply existing services at Wellington Airport are likely to arise when the additional flights that are forecast to occur under each option arrive during peak periods of demand for airport services at Wellington Airport.

Overall, it is expected that Option 1 and Option 2 would have minimal effect on the congestion costs that airlines experience when continuing to supply existing airline services at Wellington Airport. Rather, as discussed further in Section 5.2.3, by extending the runway,

those options are more likely to reduce those congestion costs by shifting some of the passengers and airfreight that would otherwise have been carried during peak periods (e.g. the existing passengers and freight travelling on long-haul trips to and from Wellington Airport) from peak periods to off peak periods at Wellington Airport.

By contrast, Option 3 has the potential to increase the congestion costs airlines incur when continuing to supply existing airline services at Wellington Airport to the extent that:

- A greater number of narrow-bodied aircraft flights are required at Wellington Airport to meet the forecast increase in passenger and airfreight demand under this option.
- Those aircraft are more likely to arrive at times within the periods of peak demand for Wellington Airport's services than under Option 1 and Option 2 (e.g. it is likely that those additional aircraft would arrive and depart at much the same times as they do for existing flights, rather than outside peak periods as is anticipated under Option 1 and Option 2).

Incremental economic costs for airlines supplying additional services

Each option would require airlines to incur additional economic costs to supply the additional airline services required to meet the forecast increase in demand for those services (i.e. the quantities of additional airline services that are forecast to be supplied under each of the options in relation to the "base case"). It is only the real value of New Zealand resources that are used by airlines to supply these additional airline services that are relevant for the purposes of this analysis.

Increased capital costs for airlines supplying additional services

The magnitude of the incremental capital costs that airlines would have to incur under each of the options to supply the forecast increase in demand for airline services will depend on both the:

- Magnitude of that forecast increase in demand for airline services over the period of analysis.
- Extent to which airlines have aircraft fleets with sufficient capacity to meet that forecast increase in demand without the need to purchase or lease additional aircraft.

We assume that airlines have sufficient capacity to meet the forecast increase in demand for airline services under each option without having to purchase or lease additional aircraft.⁶³ This means that airlines would not have to incur additional capital costs to transport the forecast increases in passengers and airfreight under each of the option, over and above the additional capital cost that they would have to incur to transport the number of passengers and quantity of airfreight that is forecast to occur under the "base case".

⁶³ This is consistent with our assumption that the additional airline services supplied at Wellington Airport under each of the options would be supplied by foreign owned airlines, and hence the costs incurred by those foreign airlines are not relevant to this CBA.

Although it is assumed that airlines would not have to purchase or lease additional aircraft to supply the increased airline services required to meet the forecast increase in demand for those services under each of the options, they would have additional flexibility under Option 1 and Option 2 to use more technically and economically efficient wide-bodied aircraft, to meet the forecast increase in demand for airline services under each of those options.

As discussed further in Section 5.2.2, this would generate benefits for airlines by reducing the additional capital costs that they otherwise would have had to incur in order to supply those additional airline services using the existing types of aircraft that are able to use Wellington Airport at the moment.

By contrast, under Option 3, airlines would have to use the existing types of aircraft that are able to operate at Wellington Airport in the absence of an extended runway to supply the additional airline services required to meet the forecast in demand under this option.

Increased operating costs for airlines supplying additional services

To supply the additional airline services required to meet the forecast increase in demand for services under each of the options, airlines would have to incur additional operating costs. These increased real operating costs for the airlines supplying additional services include the:

- Real economic value of the additional airport services used to supply those additional airline services.
- Real economic value of the additional labour and inputs of other resources used to supply the additional airline services (e.g. additional fuel, labour, etc.).
- Other additional economic costs that airlines would incur to supply those additional airline services (e.g. any additional congestion costs that those airlines incur in the course of supplying those additional airline services).

Again, it is only the real value of New Zealand resources that airlines use to supply the additional airline services that is relevant for the purposes of this analysis. Ideally, to estimate the real value of New Zealand's resources that airlines would use to supply the forecast increase in aircraft and passengers visiting Wellington Airport, detailed information would be required on the:

- Quantities and economic values of the resources that would be used by foreign and New Zealand owned airlines to supply the forecast increase in airline services, which will vary across airlines (e.g. full service carriers as opposed to low cost carriers) and routes.
- Ownership of those resources used. The main types of New Zealand resources that are likely to be used by foreign airlines to supply the forecast additional airline services are expected to include:
 - Airport costs, such as the opportunity cost of the aircraft and passenger services supplied by WIAL, which have already been taken into account in the estimates of the economic costs of WIAL supplying those services. These costs only comprise a relatively small proportion of the total operating costs associated with supplying airline services.
 - Aircraft refuelling costs, which are likely to be the main economic costs that foreign airlines incur while they are in New Zealand.
 - Aircraft servicing and maintenance costs in New Zealand.

In practice, however, only limited information is available on generalised airline costs and ownership structures. As a result, for the purposes of this report:

- It has been assumed for simplicity that:
 - All of the additional airline services supplied at Wellington Airport under each of the options would be supplied by foreign owned airlines.
 - Although these foreign airlines would use additional New Zealand resources to supply those additional airline services at Wellington Airport, which represent an economic cost to those airlines and the nation as a whole, the net benefit that they would derive from the use of those New Zealand resources (i.e. the additional “producer surplus”) would not represent a net benefit to New Zealand. Rather, it would represent a net benefit to the countries of residence of those foreign owned airlines.
- Both the costs and benefits that airlines would incur and derive from the supply of those additional airline services have been excluded from the analysis. Since airlines are unlikely to be willing to supply the forecast additional airline services unless they are able to make a normal rate of return on their investment, the net effect of this approach is to underestimate the net benefits of each option by an amount equal to the net benefits that any New Zealand owned airlines would derive if they supply some of those forecast additional airline services.

In addition to increased operating costs, airlines would also potentially incur other additional economic costs in the course of supplying the additional airline services, such as additional congestion costs.

Once again, the magnitude of these potential additional congestion costs that will be incurred by airlines supplying additional services at Wellington Airport will depend on the:

- Total number of additional flights forecast to occur at Wellington Airport under each of the options.
- Extent to which those additional flights occur within or outside the peak periods of demand for airport services at Wellington Airport. In general, the highest congestion costs for airlines continuing to supply existing services at Wellington Airport are likely to arise when the additional flights that are forecast to occur under each of the alternative options arrive during peak periods of demand for airport services at Wellington Airport.

As indicated in Table 12, it is estimated that Option 1 and Option 2 would not increase the congestion costs that airlines experience when continuing to supply existing airline services at Wellington Airport since the additional flights are expected to occur outside the periods of peak airport demand. Rather, as discussed further in Section 5.2.3, by extending the runway, those options are more likely to reduce those congestion costs by shifting some of the passengers and airfreight that would otherwise have been carried during peak periods (e.g. the existing passengers and freight travelling on long-haul trips to and from Wellington Airport) from peak periods to off peak periods at Wellington Airport.

By contrast, Option 3 has the potential to increase the congestion costs airlines incur when continuing to supply existing airline services at Wellington Airport to the extent that:

- A greater number of narrow-bodied aircraft flights are required at Wellington Airport to meet the forecast increase in passenger and airfreight demand under this option.
- Those aircraft are more likely to arrive at times within the periods of peak demand for Wellington Airport's services than under Option 1 and Option 2 (e.g. it is likely that those additional aircraft would arrive and depart at much the same times as they do for existing flights, rather than outside peak periods as is anticipated under Option 1 and Option 2).

The economic cost of some of those additional congestion costs that do arise under each option is already included in the estimates of the additional capital and operating costs that airlines would have to incur under each option to the extent that:

- Airports already charge higher prices for their airport services during peak periods of demand.
- Those additional charges are included in the prices that airlines charge for airline services during those periods of peak airport demand.

As a result, it is assumed for the purposes of the analysis presented in this section that there are no additional congestions costs arising under Option 3 that are not already taken into account in the estimated additional capital and operating costs of supplying the additional airline services under that option. This simplifying assumption, regarding the extent to which the prices charged by airports and airlines for their services reflect the social marginal costs of supplying those services, is relaxed in Section 7.1 of this report.

5.1.3 Incremental economic costs for users of airline services

The incremental economic costs that users of airline services would incur under each of the alternative options, which are set out in Table 13 and discussed further below, include both the:

- Incremental economic costs that existing users of airline services would have to incur under each of the options.
- Incremental economic costs that the users of additional airline services at Wellington Airport would have to incur under each of the options.

Table 13 Incremental economic costs of each option for users of airline services

ECONOMIC COST ITEM	OPTION 1 '\$000	OPTION 2 '\$000	OPTION 3 '\$000
Incremental economic costs for users of additional airline services:			
• Generalised cost of additional airline services used by outbound residents	470,360	205,195	470,360
• Generalised cost of additional freight services used by airfreight users	363,956	158,390	363,956
TOTAL INCREMENTAL ECONOMIC COSTS FOR USERS	834,316	363,585	834,316

Incremental economic costs for users of existing airline services at Wellington Airport

To travel “long-haul” distances to and from the Wellington region, passengers and airfreight users have to consume a range of real resources that represent not only a real economic cost to those users, but also to the nation as a whole. In particular, at the moment (i.e. under the “base case”), passengers and airfreight travelling “long-haul” distances to and from the Wellington region have to incur a range of “generalised” costs including:

- Domestic transportation costs, which are equal to the economic value of:
 - Any domestic road transport services that are used to transport those passengers and that freight between its original point of origin or destination, within the Wellington region and either Wellington Airport or the international airport, where it will embark or has disembarked from the international airline leg of its journey.
 - Any domestic airline services that are used to transport those passengers, and that airfreight between Wellington Airport and the New Zealand international airport where it will embark on or has disembarked from the international airline leg of its journey.
- International transportation costs, which are equal to the economic value of the resources that are used to transport passengers and freight by air between the international airport in New Zealand and an overseas international airport.
- Other “generalised costs” of “long-haul” transport to and from Wellington Airport, which include the:
 - Opportunity cost of the total amount of time that passengers and freight spend travelling over long-haul routes to and from the Wellington region.
 - Opportunity cost of any other resources passengers and airfreights users use in travelling long-haul distances to and from the Wellington region. This includes the “search costs” and other “compliance costs” that passengers and users of airfreight services incur to use “long-haul” airline services (i.e. the opportunity cost of the time and resources that passengers and airfreight users devote to arranging the domestic and international legs of their trips).

Once again, each option has the potential to both increase and reduce those generalised costs.

By increasing the costs of supplying airport and airline services at Wellington Airport, both Option 1 and Option 2 have the potential to increase the financial costs that users of airline services would incur to continue to use existing airline services at Wellington Airport. However, as noted above, we assume at this stage of the analysis that the capital costs associated of Option 1 and Option 2 would be fully funded by general taxation revenue. As a result, WIAL and airline operators at Wellington Airport would not have to increase airport charges, airfares and airfreight charges at Wellington Airport to recover those costs. This simplifying assumption regarding the funding of the proposed runway extension under Option 1 and Option 2 is then relaxed in Section 7.1 of this report to consider a range of alternative approaches to funding the proposed runway extension.

At the same time, however, both Option 1 and Option 2 could be expected to reduce the economic costs of supplying airport and airline services at Wellington Airport, thereby

reducing the generalised costs of existing airline services to users. These benefits for users are discussed further in Section 5.2.3.

Incremental economic costs for users of additional airline services at Wellington Airport

Now consider the effect that each of the alternative options is expected to have on the economic costs incurred by the users of the additional airline services that are supplied at Wellington Airport under each of the alternative options. These users of those additional airline services include both:

- Existing users of airline services at Wellington Airport that increase their use of those services under each option.
- New users of airline services at Wellington Airport (i.e. those passengers and airfreight users that do not currently use Wellington Airport), who decide to use airline services at Wellington Airport as a result of each of the alternative options.

Although all resident and non-resident users of these additional airline services would have to incur additional economic costs in order to use those additional airline services, it is only the additional economic costs incurred by New Zealand residents that are relevant for the purposes of this national welfare analysis.

The magnitude of these incremental economic costs that residents would incur in order to use these additional airline services has been estimated by:

- Using InterVISTAS forecasts of the:
 - Additional numbers of New Zealand outbound passengers that are forecast to use Wellington Airport under each of the options.
 - Additional volume of freight that is forecast to use Wellington Airport under each of the options, which includes the:
 - (i) Additional airfreight that is assumed to be carried under Option 1 and Option 2 by the additional wide-bodied aircraft forecast to use Wellington Airport under those options. Specifically, it has been assumed that around 3.8 tonnes of additional airfreight would be carried by each additional wide-bodied aircraft forecast to use Wellington Airport under the “most likely” Option 1 scenario. Under this assumption, the volume of airfreight under Option 1 would increase over the period of analysis to around 25,000 tonnes per annum by 2058/59, which is consistent with airfreight forecasts developed by prior studies.⁶⁴
 - (ii) Additional freight that is forecast to use Wellington Airport under Option 3. Although it is assumed that Option 3 would result in the same increase in freight using Wellington Airport as under Option 1, an important difference

⁶⁴ See for example EY (2014), *Wellington International Airport Limited, Economic impact of the proposed runway extension*, p25, <http://www.connectwellington.co.nz/static/documents/WIAL-Economic-Impact-Report-010414.pdf>

between these two options is that under Option 3, additional freight would have to be transported by road to Auckland in order to travel overseas.

- Multiplying those forecasts increases in volumes of passengers and freight respectively by the:
 - Estimated generalised costs that passengers would incur in order to use those additional passenger airline services. This generalised cost has been conservatively estimated as being equal to the average market prices charged by airlines for those passenger services (i.e. average airfares). The actual generalised cost incurred by passengers will of course still exceed these market prices by an amount equal to the value of any remaining opportunity cost of time spent travelling by those passengers under each of the options.
 - Estimated generalised costs that airfreight users would incur to use those additional freight services. Once again, this generalised cost has been conservatively estimated as being equal to the assumed average market price of airfreight of \$5 per kilogram.⁶⁵

As indicated in Table 13, using this approach, it is estimated that the users of the additional airline services under each option would incur:

- \$834m of additional economic costs under Option 1 and Option 3.
- \$364m of additional economic costs under Option 2, which is less than under Option 1 since the operation of the longer runway is deferred under Option 2.

5.1.4 Economic costs for other sections of the community

Not all of the real economic costs of each option would be borne by airports, airlines and users of those airline services. Rather, some of those real economic costs would be incurred by other sections of the community that are not directly involved in the construction, operation or use of Wellington Airport.

These “external” economic costs of the options include the:

- Incremental environmental costs arising from each option.
- Incremental economic costs that New Zealand businesses incur when they supply additional goods and services to non-resident visitors to New Zealand, including accommodation services.
- Loss of the flexibility to defer the project until there is greater certainty surrounding its economic costs and benefits (i.e. a reduction in the value of the “real option” to defer the construction of an extended runway).
- Incremental economic cost of establishing the fund to promote Wellington Airport as a tourist and airfreight hub.

⁶⁵ This is an approximation as airfreight charges vary greatly depending on type of cargo and destination, see for example: <http://www.airnewzealand.co.nz/national-cargo-our-prices>

- Incremental economic costs that the nation as a whole would incur to raise the additional revenue required to fund the alternative options (i.e. the “deadweight costs” associated with the use of inefficient user charges and taxes to raise that additional revenue).

Estimates of the present value of each of the incremental real external costs arising under each of the options in relation to the base case are presented in Table 14 and discussed further below.

Table 14 Incremental economic costs of each option for other sections of the community

ECONOMIC COST ITEM	OPTION 1 \$'000	OPTION 2 \$'000	OPTION 3 \$'000
Incremental environmental costs			
• Environmental costs	Equal highest	Equal highest	Similar to Option 1
• Cost of additional goods and services supplied to international visitors	550,513	236,772	550,513
• Cost of losing the flexibility to defer the project	Highest	Second highest	Lowest
• Capital cost of establishing the fund to promote WIA as hub	na	na	305,583
• Cost of raising the revenue to fund the project	61,117	31,069	61,117
TOTAL INCREMENTAL ECONOMIC COSTS FOR OTHER SECTIONS OF THE COMMUNITY	611,630	267,841	917,213

Incremental environmental costs

As outlined in Table 15, a range of work has been completed to date on the potential environmental impacts of the proposed runway extension that would occur under both Option 1 and Option 2.

A qualitative approach to the assessment of the potential relative magnitudes of the environmental impacts of the alternative project options has been adopted for the purposes of this report in view of the difficulties associated with monetising those impacts. For example, consider greenhouse gas emissions, where the high-level trade-off is between the introduction of new more fuel efficient aircraft and the rise in total aircraft movements that is forecast to result from the runway extension. While greenhouse gas emissions have been converted into monetary values in other contexts, expert advice suggests that it is not straightforward to calculate the likely emissions effects in air travel.⁶⁶ Airline decisions in terms of load factors, seating configuration, thrust settings and ultimately fuel burn drive substantial variation in likely emissions.

A review of the various reports suggests that impacts of the proposed runway extension from a regional scale are, on the whole, relatively modest, albeit this impact does increase the closer one is to the extension. Further, the majority of the impacts are restricted to the construction phase of the runway extension. That said, in the majority of instances where potential negative impacts are identified, options to mitigate those effects have been proposed. Many of these measures are difficult to quantify and monetise, while others are included in the estimated constructions costs of the runway extension. Examples of mitigation options include:

⁶⁶ Astral Aviation Consultants, personal communication.

- Creation of a variety of smooth and pitted surfaces in the primary armour (acropods) used in construction of the runway extension sea wall to improve the marine habitat and marine biodiversity.
- Installation of a submerged wave focusing structure to provide better shape to waves in Middle and West Beach of Lyall Bay, with the goal of improving surfing amenity in Lyall Bay.
- Provision of new recreational opportunities along the western edge of the airport between the Spruce Goose Café and the Moa Point Road underpass by providing a defined public walking route, access to the water's edge by way of platforms set into a the armoured sea wall, and opportunities for sitting/lookout areas.
- Creation of a new edge along the eastern edge of the runway extension, which together with a beach reinstatement programme would integrate the armoured edge of the runway with the existing 'natural' edge of the embayment.
- WIAL extending its policy of purchasing (on a "willing-seller, willing-buyer" basis) the most affected dwellings on Moa Point Road should the runway extension proceed
- Implementation of a traffic management plan that will factor in the interface between haul traffic, cyclists, pedestrians, those visitors on scenic drives during weekdays and those parking or moving along the proposed haul road.
- Adherence to noise standards for construction activities, particularly along Moa Point Road where the closest residents to the proposed extension live, and where the main interface with recreationists occurs, as well as diving and spear fishing between Moa Point and Hue te Taka Peninsula.
- Formation of a Construction Liaison Group with representatives from across the range of stakeholders including (but not necessarily limited to) WIAL, the contractor, Iwi, residents and residents groups to facilitate open and clear lines of communication relating to the runway extension project from both a process and complaints perspective. This relies on the preparation of various management plans, such as a Construction Noise and Vibration Management Plan a Construction Environment Management Plan and a Traffic Management Plan.

In terms of the relative environmental impacts of the alternative options, the most obvious difference is between the "with runway" options and the "without runway" option. There has been no equivalent environmental impact assessment undertaken for Option 3. On the face of it, Option 3 appeals by virtue of avoiding construction impacts. However, the greater number of flights (given "narrow-bodied" aircraft would be used to carry the same amount of additional passengers as forecast under the runway scenario) and of the possible need to increase the hours of operation of the airfield to accommodate these increased movements would have an offsetting effect. The balance between these possible effects is not amenable to economic analysis.

Similarly, there has been no specific environmental impact assessment for Option 2, albeit in reality, Option 2 would merely defer those potential effects established under Option 1. Accordingly, it is reasonable to presume that while in present value terms, the delay in experiencing these potential environmental effects with Option 2 would be less than Option 1, in reality the potential effects would still be realised, and accordingly have been treated equally.

Table 15 Relevant information on the environmental impact of the proposed runway extension

Category	Option relevance	Source material
Noise during construction	Options 1 and 2 only	AECOM New Zealand Ltd <i>“Wellington Runway Extension Construction Noise”</i>
Operational noise effects	Options 1 and 2 only	Marshall Day Acoustics <i>“Wellington Airport Runway Extension Assessment of Aircraft Noise Effects.”</i>
Landscape and urban design impacts	Options 1 and 2 only	Boffa Miskell <i>“Wellington International Airport Limited: Airport Runway Extension Assessment of Landscape and Visual Effects and Assessment of the Natural Character of the Coastal Environment.”</i> And: <i>“Wellington International Airport Limited: Airport Runway Extension Assessment of Urban Design and Urban Planning Effects.”</i>
Cultural Values	Options 1 and 2 only	Raukura Consultants <i>“Cultural Values Report – Wellington South Runway Extension.”</i>
Archaeological effects	Options 1 and 2 only	Kevin L Jones Archaeologist <i>“Archaeological Assessment of Southern Extension for WIAL”</i>
Recreational and surf break impacts	Options 1 and 2 only	TRC Ltd <i>“Wellington International Airport Proposed Extension – Assessment of Effects on Recreation”</i> DHI Water and Environment Ltd <i>“Wellington Airport Runway Extension Surf Break Impact Assessment”</i>
Ecological and hydro-sediment effects	Options 1 and 2 only	Aquatic Environmental Sciences <i>“Assessment of Ecological Effects of the reclamation and extension to Wellington Airport.”</i> NIWA <i>“Wellington International Airport Runway Extension – Coastal Processes Assessment.”</i>
Traffic Impact Assessment	Options 1 and 2 only	Traffic Design Group <i>“Wellington International Airport, Proposed Runway Extension, Transportation Assessment Report”</i>

Economic cost of additional goods and services supplied by New Zealand businesses to non-resident visitors

As previously noted, each option is forecast to:

- Increase the number of non-resident passengers that are forecast to travel to and from New Zealand through Wellington Airport for both tourist and business purposes.
- Increase the quantity of airfreight that is exported to, and imported from, New Zealand through Wellington Airport by non-resident individuals and businesses.

Although the incremental economic costs of supplying airport and airline services to transport these additional passengers and airfreight have already been included in the analysis, the incremental additional costs of New Zealand businesses supplying other additional goods and services to those passengers and airfreight users have not.

As a result, if the gross economic value of these additional goods and services that are supplied by New Zealand businesses to those non-resident passengers and users of additional airfreight services is to be included as an economic benefit to the nation as a whole as it is in Section 5.2.4 of this report, then it is also important to ensure that the gross economic cost of supplying those additional goods and services is also included in the analysis. This includes the additional economic costs associated with supplying the forecast increase in visitors to Wellington with accommodation services to compensate the suppliers for both the additional capital and operating costs of supplying those additional services.

We estimate the incremental real economic costs that New Zealand businesses would incur in supplying additional goods and services to non-resident visitors to New Zealand by employing the cost of intermediate consumption contained in the Ministry of Business, Innovation and Employment (MBIE) post-event economic evaluation of major events.⁶⁷

These guidelines mandate the use of cost-benefit analysis as the most appropriate method to use, and also set out a step-by-step guide to completing such an evaluation. One of the key components in the guidelines relates to the national benefits resulting from international visitor expenditure. The guidelines use a figure of 75 per cent for the value of international visitor expenditure that accrues to New Zealand (i.e. the cost of goods sold or intermediate consumption is 25 per cent). Our rationale for using these guidelines as a measure of the net economic benefit to New Zealand businesses is contained in Appendix 3.

We multiply the net benefit proportion (of 75 per cent) by the estimated additional expenditure by non-resident visitors each year on goods and services supplied by New Zealand businesses. The latter has been estimated by multiplying the number of additional trips non-residents are forecast to make each year over the period of analysis by the median amount of expenditure that they spend per trip, which is set out in Table 16 below.

⁶⁷ MBIE (2013) *Major Events Development Fund – Post-event Economic Evaluation Guidelines*” Final draft for feedback. Available at: <http://www.majorevents.govt.nz/pdf-library/resource-bank/post-event-reporting/post-event-economic-evaluation-guidelines-320-kb-pdf>

Using this approach, we estimate that the economic costs of supplying the goods and services to additional visitors of each option are:

- \$551m for Option 1 and Option 3, expressed in present value terms.
- \$237m for Option 2.

Table 16 Median expenditure per trip by non-resident visitors to New Zealand by country of origin

COUNTRY OF ORIGIN OF INTERNATIONAL VISITOR	MEDIAN EXPENDITURE PER TRIP
Australia	\$1,500
China	\$4,000
Japan	\$1,500
Other Asia	\$3,000
UK	\$3,600
USA	\$3,100
Pacific	\$2,100
Other	\$3,900

Source: Statistics New Zealand International Visitor Survey Visitor Expenditure, Year ended December 2015

Economic cost of losing the flexibility to defer the project

When evaluating the economic costs and benefits of irreversible infrastructure investments that have long economic lives, it is important to take into account both the risks associated with the alternative project options, as well as the inherent uncertainty surrounding the magnitude of the estimated “risk adjusted” economic costs and benefits of those alternative options.

If there was little uncertainty surrounding the magnitude of the risks associated with each project option, then it would be a relatively straightforward task to estimate the risk adjusted economic costs and benefits of each option with a reasonably high degree of certainty. In practice, however, considerable uncertainty typically surrounds most infrastructure investments to the extent that they involve irreversible investments in assets that that can have relatively long economic lives.

In the presence of such uncertainty regarding the economic costs and benefits of a project, having the flexibility to defer the decision to go ahead with the project has a real economic value that is lost once that decision is made (i.e. having the “option” to defer the decision to construct a longer runway has a “real option” value that is foregone once that decision is made).

Traditional approaches to financial analysis of infrastructure projects, as well as economic cost benefit analyses of projects, typically seek to estimate the risk adjusted costs. Sensitivity analysis is often used to see how the results of the cost benefit analysis alter when some of the key assumptions underlying that analysis are varied. However, cost benefit analysis tends to ignore the value of these real options, not because they are irrelevant to the analysis, but rather due to the difficulty associated with estimating those values.

Although the real value of options can be difficult to estimate due to the lack of sufficient information, this does not mean that those potential benefits should be ignored. Rather, as noted by Grimes (2011), in those cases where there is some flexibility to defer an infrastructure investment, the option to delay its construction has value and there is a potential case for using a higher discount rate as a second best means of taking the value of that real option into account. We adopt this approach.

Incremental economic cost of establishing a fund to promote Wellington Airport as a tourist and airfreight hub

As indicated in Table 14, Option 3 also involves the establishment of a fund to finance the promotion of Wellington Airport as a tourist and airfreight hub, which has a present value of \$306.9m, which is equal in value to the present value of the additional real capital that would be required under Option 1.

Incremental economic cost of raising additional revenue

As discussed further in Section 7.1, to fund either of the alternative options, it would be necessary to raise additional revenue (i.e. additional “financial capital”) either through user charges and/or taxation. At this stage of the analysis, we assume that the capital costs of each option would be funded using general taxation revenue. The approach recommended by the New Zealand Treasury to estimating the economic costs of raising that revenue has been used (i.e. the economic cost of raising that revenue is equal to 20 per cent of the amount of revenue raised).

As indicated in Table 14, using this approach, it is estimated that the economic costs of raising the additional revenue required to fund the capital costs of each option are:

- \$61m for Option 1 and Option 3, expressed in present value terms.
- \$31m for Option 2.

This simplifying assumption, that general taxation revenue would be used to fund the project, is relaxed in Section 7 which considers how alternative approaches to funding the project, such as the use of local government rates and user charges, would alter the results of the cost benefit analysis.

5.2 Economic benefits

The additional economic benefits arising from each of the alternative options include the:

- Incremental real value of outputs that would be generated by each option in relation to the base case.
- Incremental real value of any reductions in economic costs arising from each of the options in relation to the base case.

These additional economic benefits include the:

- Incremental benefits for airports – that is, the additional real value of output that WIAL and other airport operators in New Zealand would supply under each option.

- Incremental benefits for airlines – that is, the additional real value of outputs that airlines would supply under each option, plus any reductions in the economic costs of supplying airline services.
- Incremental benefits for users – that is, the additional real value of airline services that passengers and airfreight users would consume under each option, plus any reductions in the “generalised cost” of transport arising under each of the options.
- Incremental benefits for the wider community who are not directly involved in either the supply or use of airport or airline services – that is, the additional real value that other sections of the community would derive from consuming, and having the option to consume, additional goods and services under each option, plus any reductions in economic costs that other sections of the community would incur as a result of each of the alternative options.

5.2.1 Incremental economic benefits for airports

The incremental real economic benefits that airports in New Zealand would derive under each of the alternative options, which are set out in Table 17 and discussed further below, include both the:

- Incremental real economic benefits that WIAL would derive under each of the options.
- Incremental real economic benefits that other airports would derive under each of the options.

Table 17 Incremental economic benefits of each option for airports

ECONOMIC BENEFIT ITEM	OPTION 1 '\$000	OPTION 2 '\$000	OPTION 3 '\$000
Incremental economic benefits for WIAL			
• Value of additional airport services supplied	15,791	6,913	15,791
• Value of additional passenger services supplied	82,140	35,366	82,140
• Residual value of extended runway	19,296	22,512	na
• Residual value of Code E aircraft gates	961	1,291	na
• Value of real option to expand services and defer investment	Highest	Second highest	0
Total incremental economic benefits for WIAL	118,188	66,082	97,931
Incremental economic benefits for other New Zealand airports			
• Cost reductions from not having to supply services to diverted flights	3,547	1,496	3,547
• Value of additional airport services supplied	9	4	9
Total incremental economic costs for other NZ airports	3,556	1,500	3,556
TOTAL INCREMENTAL ECONOMIC BENEFITS FOR AIRPORTS	121,744	67,582	101,487

Incremental economic benefits for WIAL

The incremental economic benefits that WIAL would derive under each of the alternative options include the:

- Economic value of the additional airport services that WIAL would supply to airlines under each of the alternative options.
- Residual economic value that the extended runway would have at the end of the period of analysis under Option 1 and Option 2.
- Economic value of WIAL having the flexibility under Option 1 and Option 2 to increase the airport services that it supplies, at minimal additional economic cost, to

meet unexpected future increases in the quantity and nature of airport services demanded by airlines.

Economic value of additional airport services supplied

The main benefit that WIAL would derive under each option is the economic value of the additional airport services that it is forecast to supply to airlines under each option. The magnitude of these additional economic benefits for WIAL has been estimated by:

- Forecasting the additional numbers and types of aircraft, passengers and quantities of airfreight using Wellington Airport under each of the alternative options.
- Multiplying those forecast increases in the number and type of aircraft and passengers using Wellington Airport under each of the options by the prevailing market prices that WIAL would charge airlines for the use of its runway and passenger facilities over the period of analysis.

We assume that any additional capital and operating costs that WIAL would have to incur under each option would be funded through general government revenue, rather than by WIAL increasing the market prices that it currently charges for the use of its runway, passenger terminal and airfreight handling facilities. This means that WIAL would not have to increase the prices that it charges airlines for its runway, passenger terminal, and airfreight handling services over the period of analysis to recover the costs of constructing the extended runway under Option 1 and Option 2.

This simplifying assumption regarding the funding of each of the alternative options is then relaxed in Section 7.

As indicated in Table 17, it is estimated that WIAL would derive:

- \$15.8m of economic benefits from the supply of additional airport services and \$82.1m from the supply of additional passenger services under Option 1 and Option 3.
- \$6.9m of economic benefits from the supply of additional airport services and \$35.4m from the supply of additional passenger services under Option 2, which is less than that under Option 1, since under Option 2 the operation of the extended runway is deferred, which means that the new runway is operating for a shorter period of time than under Option 1 and the benefits it generates are deferred, both of which reduce the present value of the benefits it generates over the period of analysis.

Residual economic value of the extended runway at the end of the period of analysis

Since it is assumed that the extended runway would have a useful life of 100 years and the Code E aircraft gates would have a useful life of 50 years, this means that it would still have a residual market value at the end of the period of analysis that needs to be accounted for as a benefit arising under Option 1 and Option 2, given that the full economic cost of that asset has been included in the analysis.

Specifically, as indicated in Table 17, at the end of the period of analysis:

- Under Option 1, the extended runway would still have a present value of \$19.3m (i.e. 60 per cent of its useful life) and the Code E aircraft gates would still have a present value of \$0.96m.

- Under Option 2, the extended runway would still have a present value of \$22.5m (i.e. 70 per cent of its useful life) and the Code E aircraft gates would still have a present value of \$1.3m.

Similarly, although Option 3 does not involve the construction and operation of a longer runway at Wellington Airport, in order to be as comparable to Option 1 as possible, it is assumed that:

- The government would make an up-front capital outlay to set up a fund that would be used to finance the promotion of Wellington Airport as a hub for international passenger and airfreight services in the Wellington region.
- Not all of that capital expenditure will have been used up by the end of the period of analysis. Rather, as is the case under Option 1, it is assumed that the value of that capital expenditure would still remain at the end of the period of analysis. This residual value is taken into account below as a benefit to the wider community.

Economic benefit of having the flexibility to alter the supply of airport services at Wellington Airport to meet unexpected changes demand

In addition to deriving economic benefits from supplying additional airport services to airlines under each option, WIAL would also derive economic benefits under Option 1 and Option 2 from having the flexibility to use its extended runway to meet unexpected increases in the demand for airport services from aircraft that require such an extended runway.

In effect, the construction of a longer runway under Option 1 or Option 2 increases “dynamic efficiency” of the market for airport services in Wellington by creating a “real option” for WIAL to expand the quantity and alter the type of airport services that it supplies to meet unexpected future increases and changes in the needs of airlines.

As indicated in Table 17, it is estimated that the value of the real option to alter the supply of airport services at Wellington Airport at minimal additional economic costs is likely to be the:

- Highest under Option 1, since the “real option” created by Option 2 would a higher “strike price” in present value terms and a longer economic life than under Option 2 of Option 3.
- Second highest under Option 2, since the “real option” will have a shorter economic life than it would under Option 1.
- Lowest under Option 3, since in reality that up-front investment is not irreversible like that under either Option 1 or Option 2. Rather, it could be terminated by the Government at any point in time over the period of analysis.

Incremental economic benefits for other New Zealand airports

Although each of the alternative options has the potential to impose additional economic costs on other airports in New Zealand by diverting flights, passengers and freight from those airports to Wellington Airport, this also has the potential to generate additional economic benefits for those airports, and the nation as a whole, by:

- Reducing the operating costs that those other airports would have had to incur to supply services to those diverted flights.

- Increasing the real value of output supplied by other airports.
- Giving those other airports greater flexibility to:
 - Increase the capacity of those airports to expand their services at little additional cost to meet unexpected increases in the demand for their services.
 - Defer the need to invest in expansion of their existing infrastructure to meet forecast increases in demand for their services (e.g. the need for Auckland Airport to expand its infrastructure to meet the forecast increase in demand for its services).

As indicated in Table 17, it is estimated that:

- Option 1 and Option 3 would:
 - Reduce the operating costs that other airports would have to incur by \$3.5m.
 - Increase the real value of output of other airports by \$0.009m.
 - Generate the greatest increase in the flexibility for other airports to expand their services and defer future investments.
- Option 2 would:
 - Reduce the operating costs that other airports would have to incur by \$1.5m.
 - Increase the real value of output of other airports by \$0.004m.
 - Generate the second greatest increase in the flexibility for other airports to expand their services and defer future investments.

5.2.2 Incremental economic benefits for airlines

The incremental economic benefits that airlines would derive under each of the alternative options, which are set out in Table 18 and discussed further below, include both the:

- Incremental economic benefits that existing airlines operating at Wellington Airport would derive under each of the options.
- Incremental economic benefits that other airlines would derive under each of the options.

Table 18 Incremental economic benefits of each option for airlines

ECONOMIC BENEFIT ITEM	OPTION 1 '\$000	OPTION 2 '\$000	OPTION 3 '\$000
Incremental economic benefits for airlines supplying existing services			
• Reductions in the economic cost of supplying existing airline services	5,826	2,853	0
Incremental economic benefits for airlines supplying additional services			
• Economic value of additional airline services supplied	Assumed to be derived by foreign airlines		
TOTAL INCREMENTAL ECONOMIC BENEFITS FOR NZ AIRLINES	5,826	2,853	0

Incremental economic benefits for airlines supplying existing services at Wellington Airport

By increasing the length of the runway at Wellington Airport, both Option 1 and Option 2 have the potential to reduce the economic costs that airlines would otherwise have had to incur to continue to supply existing services over the period of analysis by:

- Increasing the ability of existing aircraft operating at Wellington Airport to carry additional loads of passengers, airfreight and fuel (i.e. by reducing the extent to which the length of the existing runway at Wellington Airport reduces the load carrying capacity of existing aircraft using that runway). This has the potential to generate benefits for airlines by reducing the number of flights that would otherwise have been required to transport existing passengers and freight to and from Wellington Airport, thereby reducing total operating costs and revenue per flight. These economic benefits are reflected in both the estimated economic costs of supplying these additional services as well as the economic benefits that airlines would derive from continuing to supply existing airline services at Wellington Airport.
- Avoiding the need to supply additional link flights to transport some existing long-haul passengers to and from Wellington Airport. These avoided link flights include both avoided international link flights (e.g. between Wellington Airport and Brisbane, Sydney and Melbourne airports), as well as avoided domestic link flights (e.g. between Wellington and Auckland). The magnitude of the benefit that airlines would derive from avoided international link flights has already been included in the analysis to the extent that the forecast increase in flights between Wellington Airport and Australia have been reduced by the estimated reduction in those link flights, which reduces the additional economic costs of supplying additional airline services under each of the options. The magnitude of the benefit that airlines would derive from avoiding the need to provide domestic link flights has been estimated separately by:
 - Forecasting the reduction in domestic trunk flights that is expected to arise in the presence of an extended runway.
 - Multiplying that forecast reduction in domestic trunk flights by the economic cost of supplying those flights (i.e. by assumed market price of those flights which, for simplicity, is assumed to be the price of a Wellington to Auckland link flight).
- Reducing the operating costs that airlines would otherwise have had to incur to continue to supply existing airline services. In particular, it is estimated that the extension of the runway under Option 1 or Option 2 would reduce airline operating costs by:
 - Reducing engine maintenance costs per take-off by reducing the amount of additional engine thrust that aircraft have to use in order to take-off. These lower take-off thrust settings translate, in turn, to lower internal temperatures in the engine which significantly reduce wear and tear, particularly to turbine blades. The magnitude of these reductions in engine maintenance costs has been estimated by:
 - (i) Using the InterVISTAS forecast aircraft movements to estimate the number of take-offs at Wellington Airport (i.e. one half of the forecast aircraft movements) by aircraft type in the absence of an extended runway (i.e. under the “base case”).

- (ii) Multiplying that forecast number of take-offs by the estimated reduction in aircraft engine maintenance costs by existing type of aircraft operating at Wellington Airport.
- Reducing wheel, brake and tyre maintenance costs per landing by reducing the amount of braking force that needs to be applied to slow the aircraft (i.e. by taking advantage of the longer runway to slow the aircraft more gradually). The magnitude of these reductions in maintenance costs has been estimated by:
 - (i) Using InterVISTAS forecast number of aircraft movements to estimate the number of take-offs at Wellington Airport (i.e. one half of the number of aircraft movements) by aircraft type in the absence of an extended runway (i.e. under the “base case”).
 - (ii) Multiplying that forecast number of landings by the estimated reduction in wheel, brake and tyre maintenance costs per landing by existing type of aircraft operating at Wellington Airport.

Once again, however, it is important to note that not all of those benefits will accrue to New Zealand airlines. Rather, some of those benefits will accrue to foreign owned airlines that continue to supply these existing services at Wellington Airport. As a result, the estimated benefits that airlines would derive have been proportionally reduced to take into account only those cost savings that would be derived by New Zealand carriers on each of the routes.

As set out in Table 18, using this approach, it is estimated that New Zealand airlines would derive:

- \$5.8m of savings in aircraft maintenance costs under Option 1.
- \$2.9m of savings in aircraft maintenance costs under Option 2, which is less than under Option 1, since the commencement of the operation of the extended runway is deferred under Option 2, thereby reducing the present value of the benefits that it generates over the period of analysis.
- No savings in aircraft maintenance costs under Option 3, since the runway is not extended under this option.

Incremental economic benefits for airlines supplying additional services at Wellington Airport

Each of the alternative options would also generate economic benefits for airlines by increasing the economic value of airline services they supply at Wellington Airport.

The magnitude of those economic benefits for airlines supplying those additional airline services at Wellington Airport would be equal to the value of the additional passenger and airfreight services that they are forecast to supply under each of the options (i.e. the additional quantities of passengers and airfreight they are forecast to carry under each of the alternative options multiplied by the prices that they would charge for supplying those additional airline services, which are likely to be in the order of the average market prices set out in Table 19 below).

Once again, however, as discussed in Section 5.1.3, only those benefits that are derived by New Zealand owned airlines are relevant for the purposes of this analysis. Any benefit that

is derived by foreign owned airlines represents a benefit to the country in which those foreign airlines reside, rather than New Zealand.

As a result, we assume for simplicity that all of the additional airline services would be supplied by foreign airlines and, as a result, all of the economic costs and benefits that those airlines would incur and derive have been excluded from the analysis. This ensures that the net benefits that these foreign airlines derive from the supply of those additional services are also excluded from the analysis. The net effect of this approach is to underestimate the net benefits of each option to the extent that some of these additional airline services are supplied by New Zealand airlines (i.e. by an amount equal to the “producer surplus” that those New Zealand airlines derive from the supply of additional airline services).

Table 19 Average airfares by route (one way)

DESTINATION	AVERAGE AIRFARE (one way)
Australia	\$301
China	\$1,099
Japan	\$1,261
Other Asia	\$994
UK	\$1,221
USA	\$1,155
Pacific	\$431
Other	\$1,336

Source: Ministry of Business, Innovation and Employment (unpublished), using SABRE data

5.2.3 Incremental economic benefits for users of airline services

The ultimate beneficiaries of each option are the individuals and businesses that would use the improved and additional airport and airline services provided under those alternative options, which include:

- Passengers that use those improved and additional airline services to travel to and from Wellington Airport.
- Airfreight users, which one again include both individuals and airfreight companies that use the airfreight services supplied by airlines operating at Wellington Airport.

The incremental real economic benefits that the users of airline services would derive under each of the alternative options, which are set out in Table 20 and discussed further below, include both the:

- Incremental economic benefits that existing users of airline services derive under each of the options, and
- Incremental economic benefits that new users of airline services at Wellington Airport would derive under each of the options.

Table 20 Incremental economic benefits of each option for users of airline services

ECONOMIC BENEFIT ITEM	OPTION 1 '\$000	OPTION 2 '\$000	OPTION 3 '\$000
Incremental economic benefits for users of existing airline services			
Passengers:			
• Reductions in the generalised cost of travel for outbound residents	724,132	322,972	0
Airfreight users:			
• Reductions in the generalised cost of freight	1,956	852	0
<i>Total incremental economic benefits for users of existing services</i>	<i>726,088</i>	<i>323,824</i>	<i>0</i>
Incremental economic benefits for users of additional airline services			
Passengers:			
• Value in exchange of additional airline services used by outbound residents	470,360	205,195	470,360
• "Consumer surplus" derived from use of additional services by residents	40,681	17,622	40,681
Airfreight users:			
• Value in exchange of additional airfreight services used	363,956	158,390	363,956
<i>Total incremental economic benefits for users of additional services</i>	<i>874,997</i>	<i>381,207</i>	<i>874,997</i>
TOTAL INCREMENTAL ECONOMIC BENEFITS FOR USERS OF AIRLINE SERVICES	1,601,085	705,030	874,997

Incremental economic benefits for users of existing airline services at Wellington Airport

Each option has the potential to generate economic benefits for the users of the existing airline services that are forecast to be provided under the “base case” (i.e. “existing users”) by reducing the “generalised cost” of using those transport services. These generalised costs include the:

- Transport costs incurred by users of airline services, which include the:
 - Airfares and airfreight charges they pay.
 - Other transport costs they incur to travel to and from the airport (e.g. road transport costs).
- Opportunity cost of the time that:
 - Passengers spend flying, waiting at airports, and travelling to and from those airports.
 - Airfreight users spend waiting for their deliveries.

For example, Option 1 and, to a lesser extent, Option 2, have the potential to:

- Reduce the total transport costs incurred by passengers and airfreight users by:
 - Reducing the number of separate trips that passengers and airfreight users have to make to travel “long-haul” distances to and from Wellington Airport (i.e. cost reductions arising from “avoided travel”), which include both avoided flights (e.g. link flights between Wellington Airport and Auckland, Christchurch, Sydney, Brisbane or Melbourne) as well as avoided road transport.
 - Potentially reducing the airfares and airfreight charges that airlines charge for the existing services they supply at Wellington Airport to the extent that they pass on any cost savings arising from the use of the longer runway to users of those existing airline services.

- Reduce the amount of time that passengers and airfreight spend:
 - Travelling between their point of origin or destination in the Wellington region, and their point of origin or destination overseas by eliminating the need for a link flight or road transport between Wellington Airport and another international airport in New Zealand (e.g. Auckland or Christchurch).
 - Planning and organising their travel (e.g. amount of time spent planning the necessary routes and purchasing the necessary airfares).

By contrast, Option 3 only has the potential to reduce the generalised costs of travel to the extent that it helps to inform passengers and airfreight users of the options that they have to use Wellington Airport in the future (i.e. by reducing any existing “information asymmetries” between the suppliers of airport and airline services at Wellington Airport and potential passengers and airfreight users that are currently not aware of those options) and reduces the compliance and administrative costs of planning trips.

Although both resident and non-resident users of existing airline services would potentially derive benefits from each of the options, the benefits derived by non-residents do not constitute a benefit to New Zealand unless the actual economic incidence of those benefits is passed back to New Zealand. For example, the higher generalised cost of travel using Wellington Airport under the base case is passed back to New Zealand as a result of fewer international visitors coming to New Zealand). Other than considering the increase in the number of visitors, should the runway be extended, we do not include any estimate for savings that do accrue to non-residents being passed through to New Zealand (e.g. greater expenditure in New Zealand by visitors who would have come anyway but would have cheaper options if the runway is extended). This approach understates the net benefits.

The magnitude of the economic benefits that outbound New Zealand residents derive from their existing trips overseas, and resident businesses derive from additional outbound and inbound airfreight, has been estimated by:

- Estimating the extent to which each of the options is expected to:
 - Reduce the generalised cost of travel for passengers and freight over each of the existing routes from Wellington Airport. Option 1 and Option 2 both have the potential to reduce the additional airfares and travel time that passengers currently incur when travelling long-haul distances to and from Wellington, which are set out in Table 21 below. The opportunity cost of passenger time has been obtained from the Civil Aviation Safety Authority Standard Economic Values Guidelines for 2010, which have been inflated into \$2015/16 and adjusted for the exchange rate, which yields an opportunity cost of \$53.60 per hour for individuals and \$76.42 per hour for business passengers.⁶⁸ Support for our use of these values is provided in Appendix 4. The amount of travel time that passengers and airfreight users can avoid by using direct flights can vary significantly by route and can exceed ten hours. For the purposes of this report, however, the maximum time savings on each route have been capped at six hours.

⁶⁸ Civil Aviation Safety Authority (2010), *Standard Economic Values Guidelines*, ASA
<https://www.casa.gov.au/manuals-and-forms/standard-page/standard-economic-values-guidelines-manual>

- Reduce the generalised cost of airfreight services. Option 1 and Option 2 would both reduce the amount of time that freight currently has to spend being transported by road between Wellington and Auckland. The value of time for freight is assumed to be \$45 per tonne per hour, based on the NZTA economic evaluation guidelines taking into account the differential in the value of freight that is transport via land and air
- Multiplying those estimated reductions in generalised costs of travel respectively by the forecast volumes of existing long-haul outbound residents and airfreight that is expected to fly direct from Wellington Airport following the runway extension. Not all existing outbound passengers and airfreight would use direct services to their destinations from Wellington Airport, instead reaching their destination indirectly via Auckland, Christchurch, Sydney, Brisbane or Melbourne. As a result, for simplicity, it is assumed under each of the options that:
 - Existing outbound residents and airfreight travelling to Australia, the Pacific, or long-haul routes not serviced by a direct flight from Wellington Airport would not derive any reductions in generalised costs over the entire period of analysis. This understates the potential benefits to the extent that some passengers and airfreight travelling to Australia would still benefit from a direct flight (e.g. passengers and airfreight travelling to parts of Australia other than Sydney, Melbourne and Brisbane).
 - On average, over the entire period of analysis, for the most likely scenario 60 per cent of the remaining outbound passengers and airfreight flying long-haul distances would fly directly overseas from Wellington Airport and would experience a reduction in the generalised cost of travel.⁶⁹ This simplifying assumption was derived on a weighted average basis across time, and is then relaxed to consider the sensitivity of the results of the analysis to changes in this assumption.

As indicated in Table 20, using this approach, it is estimated that users of existing airline services at Wellington Airport would derive additional economic benefits of:

- \$726.1m under Option 1.
- \$323.8m under Option 2.
- No benefits under Option 3.

⁶⁹ The low scenario proportion is 49% while the high scenario proportion is 62%.

Table 21 Reductions in the generalised cost of passenger airline transport by route and type of passenger

DESTINATION	AVERAGE REDUCTION IN GENERALISED COST OF TRAVEL		
	LOW	MOST LIKELY	HIGH
Outbound resident tourists			
Australia	\$0	\$0	\$0
China	\$128	\$228	\$342
Other Asia	\$81	\$171	\$342
UK	\$128	\$228	\$342
USA	\$128	\$285	\$342
Outbound resident business people			
Australia	\$0	\$0	\$0
China	\$183	\$325	\$488
Other Asia	\$115	\$244	\$488
UK	\$183	\$325	\$488
USA	\$183	\$406	\$488

Incremental economic benefits for users of additional airline services at Wellington Airport

By reducing the generalised costs of travel, each option has the potential to increase travel to and from Wellington by both outbound New Zealand residents and inbound non-resident visitors to New Zealand.

This increase in travel would generate economic benefits for those residents and non-residents that are equal to the “value in use” of those additional airline services, which are equal to the sum of the:

- “Value in exchange” of those additional airline services (i.e. the amount users pay for those additional airline services, which is equal to the generalised cost of using those additional airline services, multiplied by the quantity of those additional airlines services used),
- Plus the additional value that users derive from the additional airline services they use that exceeds what they actually paid for those services (i.e. the additional “consumer surplus” that those users derive from the consumption of those additional services, which is equal to amount they would have been willing to pay for those additional airline services, less what they actually had to pay to use those services).

Once again, although non-resident visitors to Wellington would derive economic benefits from their use of these additional airline services, those benefits do not constitute a benefit to New Zealand and are therefore excluded from the cost benefit analysis.

The magnitude of the economic benefits that outbound New Zealand residents derive from their additional trips overseas, and resident businesses derive from additional outbound and inbound airfreight, is influenced by a range of factors, including the:

- Magnitude of the reduction in the generalised costs of resident passengers and airfreight travelling to and from Wellington that is expected to occur under each option, which have been outlined above.

- Extent to which users increase the quantities of airline services they use in response to those reductions in generalised costs (i.e. the income compensated own price elasticity of outbound passenger demand and the price elasticity of demand for airfreight services), which is discussed further below.

Although there are no detailed estimates of the price elasticity of demand for non-resident travel to Wellington, there are reasonably detailed estimates available of the price elasticities of demand for non-residents visiting New Zealand. For example, Schiff and Becken (2011) provide estimates of the:

- Sensitivity of arrivals by non-resident visitors in New Zealand to the “total price” of visiting New Zealand, which includes the price of airfares as well as “on the ground” consumption of goods and services” (i.e. the “price” elasticity of “arrivals” by non-residents visitors to New Zealand), which are set out in in Table 22 below. These estimates indicate that the decision by non-resident visitors from Asia to travel to New Zealand is much more sensitive to changes in price (with arrival elasticities ranging from -0.19 to -2.85) than are the decisions by non-resident visitors from Australia (with arrival elasticities ranging from -0.08 to -1.74), the UK (with arrival elasticities ranging from -0.11 to -0.93), the USA (with arrival elasticities ranging from -0.09 to -1.06), and Germany (with arrival elasticities ranging from -0.2 to -1.54).
- Sensitivity of expenditure by those non-resident visitors to changes in the cost of visiting New Zealand (i.e. the “price” elasticity of “expenditure” by non-resident visitors to New Zealand), which are set out in Table 23 below. These estimated expenditure elasticities are broadly consistent with the price elasticities of demand for arrivals in New Zealand outlined in Table 22, except for tourists travelling from Japan on tour, whose expenditure is less sensitive to price than is their decision to travel to New Zealand. As noted by Schiff and Becken, visitors in tour segments appear to be slightly less price sensitive in terms of their on the ground expenditure than visitors in other segments, which is not surprising given that tour group visitors have already prepaid much of their tourism products, often in combination with the airfare, and the individual demand on the ground at the time of travel is comparatively low.⁷⁰

⁷⁰ Schiff and Becken (2011), p 570.

Table 22 Estimated price elasticity of international visitor arrivals in New Zealand by country of origin and purpose of travel

Origin of inbound passenger and purpose of visit	Elasticity	Standard error	Range of inbound passenger elasticity estimates (90% confidence)	
			Lower bound	Upper bound
Australia FIT Holiday	-0.26	0.11	-0.08	-0.44
Australia FIT VFR	-1.05	0.42	-0.36	-1.74
Australia FIT Other	na	na	na	na
Australia Tour	-0.31	0.13	-0.10	-0.52
UK Holiday	-0.52	0.25	-0.11	-0.93
UK VFR and Other	na	na	na	na
USA FIT Holiday	-0.29	0.12	-0.09	-0.49
USA FIT VFR and other	na	na	na	na
USA Tour	-0.78	0.17	-0.50	-1.06
Japan FIT Holiday	na	na	na	na
Japan FIT VFR and Other	na	na	na	na
Japan Tour	-1.55	0.48	-0.76	-2.34
South Korea All	-1.75	0.64	-0.70	-2.80
China FIT	-1.65	0.73	-0.45	-2.85
China Tour	-1.09	0.55	-0.19	-1.99
Germany All	-0.87	0.41	-0.20	-1.54

Source: Schiff and Becken (2011), Table 2, page 568

Table 23 Estimated price elasticity of international visitor expenditure in New Zealand by country of origin and purpose of travel

Origin of inbound passenger and purpose of visit	Elasticity of expenditure	Standard error	Range of inbound passenger expenditure elasticity estimates (90% confidence)	
			Lower bound	Upper bound
Australia FIT Holiday	na	na	na	na
Australia FIT VFR	na	na	na	na
Australia FIT Other	na	na	na	na
Australia Tour	na	na	na	na
UK Holiday	-0.40	0.16	-0.14	-0.66
UK VFR and Other	-0.51	0.24	-0.12	-0.90
USA FIT Holiday	-0.55	0.16	-0.29	-0.81
USA FIT VFR and other	-0.51	0.23	-0.13	-0.89
USA Tour	-0.46	0.24	-0.07	-0.85
Japan FIT Holiday	-1.17	0.31	-0.66	-1.68
Japan FIT VFR and Other	na	na	na	na
Japan Tour	-0.36	0.17	-0.08	-0.64
South Korea All	na	na	na	na
China FIT	-1.70	0.86	-0.29	-3.11
China Tour	na	na	na	na
Germany All	na	na	na	na

Source: Schiff and Becken (2011), Table 3, page 569, with 90 per cent confidence intervals calculating using standard errors

Similarly detailed and rigorously derived estimates are not available for the price elasticity of demand for outbound residents travelling overseas or for airfreight services to and from Wellington Airport. This is not a problem that is unique to New Zealand. There is much less detailed empirical data available on the price elasticities of demand for outbound travel by residents for most countries than there is on the price elasticities of inbound travel by international visitors to those countries.

In view of this lack of information on the price elasticity of outbound passenger demand, IATA recommends the use of a “rule of thumb” pending the results of further research. In brief, that “rule of thumb” involves multiplying their estimated price elasticities of passenger demand by a factor of:

- 1.3 to obtain estimates of the price elasticity of demand for inbound travel by non-residents.
- 0.8 to obtain an estimate of the price elasticity of demand for outbound travel by residents.⁷¹

This means that, under such an approach, the estimated price elasticity of demand for outbound travel is equal to the estimated price elasticity demand for inbound travel multiplied by a factor of 0.615 (i.e. $0.8/1.3$). This factor can be applied to each of the inbound elasticity estimates set out in Table 22 above, to develop “rule of thumb” upper and lower bound estimates of the price elasticities of outbound travel demand in New Zealand by country of destination. These estimates are set out in Table 24 below.

Table 24 “Rule of thumb” estimates of the price elasticity of outbound New Zealand residents travelling overseas by country of destination and purpose of travel

Destination of outbound passenger and purpose of visit	Range of outbound passenger elasticity estimates (90% confidence)	
	Lower bound	Upper bound
Australia FIT Holiday	-0.05	-0.27
Australia FIT VFR	-0.22	-1.07
Australia FIT Other	na	na
Australia Tour	-0.06	-0.32
UK Holiday	-0.07	-0.57
UK VFR and Other	na	na
USA FIT Holiday	-0.06	-0.30
USA FIT VFR and other	na	na
USA Tour	-0.31	-0.65
Japan FIT Holiday	na	na
Japan FIT VFR and Other	na	na
Japan Tour	-0.47	-1.44
South Korea All	-0.43	-1.72
China FIT	-0.28	-1.75
China Tour	-0.11	-1.23
Germany All	-0.12	-0.95

⁷¹ IATA (2008), *Air Travel Demand*, IATA Economics Briefing No. 9, April 2008.
https://www.iata.org/whatwedo/documents/economics/air_travel_demand.pdf

Source: Derived from estimates of inbound price elasticities of demand estimated Schiff and Becken (2011), Table 2, page 568, adjusted using IATA methodology as outlined above

In view of the somewhat arbitrary nature of this “rule of thumb” approach to estimating outbound price elasticities of demand, it is useful to compare those “rule of thumb” estimates in Table 24 with actual estimates of outbound demand elasticities that have been obtained for other jurisdictions where the outbound residents are likely to have similar tastes and budgets to those of outbound New Zealand residents.

For example, Athanasopoulos, Deng, Li and Song (2013) have used a much more rigorous empirical approach to derive:

- Short run estimates of the elasticity of expenditure by Australian residents on both domestic tourism and outbound tourism, which are set out in Table 25 below. This indicates that expenditure by Australian residents on domestic tourism is less sensitive to changes in price (with an expenditure elasticity ranging from 0.811 to 1.055) than expenditure by Australian residents on outbound tourism to Asia, the USA and the UK. In general, the estimated sensitivity of expenditure by Australian residents on outbound travel to Asia (expenditure elasticity estimates ranging from 0.676 to 1.768) is broadly consistent with the “rule of thumb” estimates of the price sensitivity of non-residents arriving from Asia or of visiting New Zealand (arrival elasticities ranging from 0.11 to 1.75). By contrast, the estimated sensitivity of travel by outbound Australians to the USA and the UK are greater than the “rule of thumb” estimates, largely as a result of the “package tour” effects that are inherent in those estimates.
- Estimates of the income compensated:
 - Own price elasticity of demand for domestic tourism in each country, which are indicated in the “diagonal” elements of Table 26. For example, the first element in the second column of Table 26 indicates that the own price elasticity of demand for domestic tourism by Australian residents (i.e. -0.29) is less sensitive to changes in price than is the demand by the residents of Asia, the USA and the UK for domestic tourism in their respective countries of residence.
 - Cross price elasticity of demand for tourism, which is indicated by each of the “off-diagonal” elements of Table 26. In particular, as set out in more detail in Table 27, the second, third, and fourth elements of the second column in Table 26 provide estimates of the elasticity of demand by outbound Australian residents for tourism in Asia, the USA and the UK respectively, in response to a change in the relative price of that outbound tourism in relation to domestic tourism in Australia. These elements have a positive sign indicating that Australian residents regard them as substitutes in consumption with domestic tourism. That is, an increase in the price of tourism to any of these destinations is expected reduce the proportion of total tourism expenditure that Australian residents spend on outbound visits to those destinations and increase the proportion of total tourism expenditure they spend on domestic tourism.

Table 25 Estimated short run elasticities of expenditure by Australian residents on domestic tourism and outbound tourism to Asia, USA and the UK

Destination of Australian resident tourist	Short-run expenditure elasticity	t statistics	Range of elasticity estimates (90% confidence)	
			Lower bound	Upper bound
Australia	0.933	12.595	0.811	1.055
Asia	1.222	3.683	0.676	1.768
USA	1.570	3.027	0.717	2.423
UK	1.299	3.351	0.661	1.937

Source: Athanasopoulos, Deng, Li and Song (2013), Table 3, p. 23, with 90 per cent confidence intervals calculated using the t statistics

Table 26 Estimated income compensated own and cross price elasticities of demand

Relative prices	Australia	Asia	USA	UK
P(AUSTRALIA)	-0.290	0.960	0.784	0.935
P(ASIA)	0.100	-0.418	-0.298	-0.583
P(USA)	0.056	-0.204	-0.825	-0.502
P(UK)	0.063	-0.377	0.474	-0.926

Source: Athanasopoulos, Deng, Li and Song (2013), Table 4, p. 24

Table 27 Estimated income compensated own and cross price elasticities of demand by Australian residents for domestic and international tourism

Relative prices	Compensated own and cross price elasticities	t statistics	Range of elasticity estimates (90% confidence)	
			Lower bound	Upper bound
P(AUSTRALIA)	-0.290	-4.969	-0.194	-0.386
P(ASIA)	0.100	3.782	0.057	0.143
P(USA)	0.056	2.095	0.012	0.100
P(UK)	0.063	2.491	0.021	0.105

Source: Athanasopoulos, Deng, Li and Song (2013), Table 4, p. 24, with 90 per cent confidence intervals calculated using the t statistics

Even greater uncertainty surrounds the price elasticity of demand for airfreight services at Wellington Airport.

Overall, the preceding discussion serves to highlight both the:

- Considerable uncertainty that still surrounds the price elasticities of demand by:
 - Inbound non-resident visitors to Wellington Airport.
 - Outbound New Zealand residents travelling overseas from Wellington Airport.

- Current and potential users of airfreight services at Wellington Airport.
- Reasons why the InterVISTAS aircraft and passenger movement forecasts reflect that uncertainty, as well as the uncertainty surrounding the extent to which each of the options would reduce the generalised costs of transporting both passengers and freight at Wellington Airport.

Indeed, those forecasts also take into account the potential impact of not just changes in the generalised cost of travel, but also changes in the information that passengers and airfreight users have about services available at Wellington Airport (i.e. they take into account the extent to which the demand for airport and airline services at Wellington Airport could be stimulated through the provision of improved information to address any existing “information asymmetries” that might be deterring demand for services at Wellington Airport).

The market stimulation impacts underlying the forecast changes in passenger numbers and flight movements have been observed widely following the introduction of services. The evidence supports market stimulation effects that can be in the thousands of per cent. IATA has developed a “generic” market stimulation curve, based on actual stimulation data that can be used by aviation industry participants to evaluate routes, infrastructure investment and the like. New demand for a route is calculated based on the existing number of passengers that take indirect flights to the destination. The stimulation effect estimated by the curve tends to be exponentially larger for smaller volumes of passengers at that particular airport for that potential direct route.⁷²

That stimulation is not restricted solely to city-pair point-to-point situations. As shown in Figure 6 earlier in the report, larger networks allow connections to smaller market to be added. Adding a point-to-point service to Singapore from Wellington, for example, opens up an array of other markets and it is these hub effects that drive the changes in passenger and aircraft movement numbers we observe. This is particularly the case for the US (Los Angeles) and Other Asia (Singapore) routes. Airlines route traffic through hubs to exploit density economies (i.e. the reduction in average costs resulting from increasing traffic at the route level). One factor important in raising passenger traffic is the attractiveness of the (hub) airport as a result of the greater number of possible destinations.⁷³

The estimates of the additional economic benefits that passengers and airfreight users would derive from their increased use of Wellington Airport that are set out in Table 20 above have been derived using InterVISTAS forecasts of the additional aircraft and passengers that are expected to visit Wellington Airport over the period of analysis.

As indicated in Table 20, it is estimated that:

- Under Option 1 and Option 3:

⁷² Sismanidou A and J Tarradellas, G Beland, X Fageda (2013) “Estimating potential long-haul air passenger traffic in national networks containing two or more dominant cities.” *Journal of Transport Geography* 26 pp.108-116.

⁷³ Ibid.

- Passengers would derive \$470m of gross benefits from their use of additional airline services and an additional “consumer surplus” (i.e. net benefit) of \$41m.
- Airfreight users would derive \$364m of gross benefits from their use of additional airline services.
- Under Option 2:
 - Passengers would derive \$205m of gross benefits from their use of additional airline services and an additional “consumer surplus” (i.e. net benefit) of \$18m.
 - Airfreight users would derive \$158m of gross benefits from their use of additional airfreight services.

Economic value of users having greater flexibility to expand their use of airline services

In addition to generating benefits for those passengers and airfreight users that actually decide to use the airport and airline services provided at Wellington Airport, the proposed extension of the runway under Option 1 or Option 2 also has the potential to generate economic benefits for potential users of those services, even if they never actually decide to use those services.

A key feature of any network, including New Zealand’s airport and airline network, is that an improvement to any part of that network (e.g. through the extension of the runway at Wellington Airport) increases the value of that network to all current and future users of that network, even if they never actually use that improved part of the network. This is because it provides all current and future users of the network with the flexibility to use the improved part of the network at a future date, which has a real economic value to users, even if they never actually use that improved part of the network.

5.2.4 Incremental economic benefits for other sections of the community

Not all of the real economic benefits of each option would be derived by airports, airlines and users of those airline services. Rather, some of those real economic benefits would be derived by other sections of the community that are not directly involved in the construction, operation, or use of Wellington Airport.

As discussed further below, these “external” economic benefits of the alternative options include the:

- Incremental environmental benefits arising under each of the options.
- Incremental economic value of other goods and services supplied by New Zealand businesses to non-resident visitors to New Zealand.
- Value of “real options” created for the wider community.
- Economic benefits arising from reducing barriers to increased competition (the potential competition benefits were discussed in 2.7 earlier in the report).

Estimates of the present value of the first two of these incremental external benefits arising under each of the options in relation to the base case are presented in Table 28 and each of these potential benefits is discussed further below.

Table 28 Incremental economic benefits of each option for other sections of the community

ECONOMIC BENEFIT ITEM	OPTION 1 \$'000	OPTION 2 \$'000	OPTION 3 \$'000
Incremental environmental benefits			
• Benefits from mitigation of environmental impacts	Equal highest	Equal highest	Lowest
Benefits for New Zealand businesses			
• Value of additional goods and services supplied to non-resident visitors	2,202,054	947,088	2,202,054
Benefits for the nation as a whole			
• Additional GST revenue collected on sales of additional goods and services to non-residents	183,394	78,876	183,394
• Residual value of fund to promote WIA as a tourist and airfreight hub	na	na	20,257
TOTAL INCREMENTAL ECONOMIC BENEFITS FOR OTHER SECTIONS OF THE COMMUNITY	2,385,447	1,025,964	2,405,704

Incremental environmental benefits arising under each of the alternative options

As noted in Section 5.1.4, a range of research has been undertaken on the potential environmental impacts of the proposed runway extension. Due to the difficulty monetising such impacts and the inclusion of the cost of mitigating some of those impacts in the construction cost estimates for the project, this report has not sought to include monetised estimates of those environmental effects in the cost benefit analysis. As a result, we have treated incremental economic benefits in the same manner.

The possible runway extension mitigation measures discussed in Section 5.1.4 also give rise to enhancements that could be characterised as benefits under Options 1 and 2. Examples include:

- The new path alongside the existing Moa Point Road from Lyall Bay Parade and on the east side of the runway extension on the sheltered bay-side will enhance the connectivity to the coastal edge.
- The existing underpass from the east to west side of the runway will be enhanced with better lighting to assist the recreational connection and extension of the recreational amenity from the open, more urban Lyall Bay coastal area to the more naturally sheltered bay to the east of the airport.
- The proposed gateway improvements at the intersection of the airport road and Moa Point Road. These gateway improvements will result in an enhanced landscape that recognises this intersection point's importance as one of a string of 'nodal' intersection points along the south coast.
- A beach reinstatement with rocky shore that can be colonised by seaweeds allows a better habitat for fish and other marine life. The positioning and materiality of rock and accropod elements can be used to promote improved ecological performance in the beach and bay.
- A submerged wave focusing structure has the potential to enhance surfing amenity for Lyall Bay.

The prospect of a reduction in greenhouse gas emissions as a result of bigger, more fuel efficient aircraft being used under Option 1 and Option 2 could translate to a benefit, but the proportion of that benefit accruing to New Zealand is hard to determine. In addition, greater numbers of aircraft movements could offset any apparent gains.

No specific environmental impact assessment of Option 2 and Option 3 has been undertaken, limiting the feasibility for an economic analysis to inform an assessment of environmental effects.

Incremental economic value of other additional goods and services supplied to non-resident visitors by New Zealand businesses

By increasing the number of non-resident visitors to New Zealand, the proposed runway extension has the potential to generate gross economic benefits for New Zealand equal to the value of goods and services that are supplied by New Zealand businesses to those non-resident visitors, excluding GST.

The magnitude of the gross value of goods and services supplied by New Zealand businesses to non-resident visitors to Wellington has been estimated by:

- Forecasting the number of additional non-residents that expected to visit Wellington each year over the period of analysis (which is equal to one half of the number of non-resident passenger trips to and from Wellington).
- Multiplying that forecast by the estimated median expenditure by each of those non-resident visitors, excluding GST, which were set out in Table 16 above.

In addition to generating economic benefits for the New Zealand businesses that supply goods and services to non-resident visitors, the New Zealand Government also benefits to the extent that those non-resident visitors pay GST on those purchases.

The magnitude of this increase in GST revenue has been estimated by:

- Estimating the effective rate of GST that non-residents pay on their purchases of goods and services (i.e. 8.3 per cent) using Tourism Satellite Account data on the amount of GST paid on tourism expenditure.
- Multiplying that effective rate of GST by the estimated GST inclusive additional median expenditure by non-resident visitors to New Zealand.

As indicated in Table 28, using this approach, it is estimated that:

- Option 1 and Option 3 would generate:
 - \$2,202m of gross benefits for New Zealand businesses.
 - \$183m of GST revenue for the New Zealand government.
- Option 2 would generate:
 - \$947m of gross benefits for New Zealand businesses.
 - \$79m of GST revenue for the New Zealand government.

In addition, under Option 3, the fund set up to promote Wellington as tourist and airfreight hub would have a residual value of \$20.3m at the end of the period of analysis.

Value of real options created for the wider community

In addition to creating real options for WIAL, airline operators at Wellington Airport, and users of airline services at Wellington Airport, the proposed extension of the runway under Option 1 and Option 2 also has the potential to create real options for the wider community.

In particular, the construction and operation of the extended runway creates real options for other businesses in the Wellington region to undertake investments that would not have been possible in the absence of that extended runway (e.g. investments in tourism and hotel development in the Wellington region).

In practice, however, traditional cost benefit analyses of investments in infrastructure projects typically ignore the value of those real options. Even when economic evaluations include some of the “wider economic benefits” arising from investments in transport infrastructure (e.g. through the inclusion of “agglomeration benefits”), the focus tends to be on external benefits arising from the actual future use of that transport infrastructure rather than the value of the real options that are created by that infrastructure for other sections of the community (i.e. those analyses often ignore the fact that these real options have a value to the community as a whole, even if those real options are never actually exercised).

As noted by Grimes (2011), one of the reasons why these wider benefits to the community are ignored is that cost benefit analyses typically evaluate the construction and operation of a new or upgraded transport link as a single-stage project.⁷⁴ On closer inspection, however, it is apparent that most transport infrastructure investments are just the first phase of a multi-stage investment program that generates wider economic benefits for the community. By treating infrastructure investments as single-stage projects, traditional cost benefit analysis therefore overlooks the real investment options created by that initial investment.

As a result, ideally the economic evaluation of major transport infrastructure projects, such as the proposed runway extension at Wellington Airport, should include quantitative estimates of the value of the real options that it creates for the community.

In practice, however, this is extremely difficult. While there are numerous methods for calculating the value of real options, it is difficult to obtain the information that is necessary to use those methods to estimate the value of the options that the wider community would derive from the investment. As noted by Grimes, a major investment in a new transport link has the potential to affect a wide range of subsequent investors, many of which would be unknown at the time the economic evaluation and the construction of the investment occurs.⁷⁵

This means that once again, it is necessary to fall back on an approach that relies instead on the use of:

- A qualitative analysis of the likely real options that the community derives from the proposed investment.
- A lower discount rate in the sensitivity analysis (e.g. 3 per cent) to compensate, to some extent, for the exclusion of the value of this real option from the analysis.

⁷⁴ Grimes, A (2011), *op cit.*

⁷⁵ Grimes, A (2011), *op cit.*

Option to use Wellington Airport for diverted flights

One of the “real options” that would be created for the wider community by extending the runway under Option 1 or Option 2 is the option for larger diverted aircraft to use Wellington Airport.

The proposition is that as a result of the runway extension would mean Wellington could then be considered as a diversion destination for wide-bodied long-haul flights, which would otherwise need to divert elsewhere due to the restricted current runway length. The benefits thought to accrue from such optionality relate to safety (i.e. less chance of placing passengers at risk) and efficiency in terms of payload capacity and fuel costs. That is, aircraft would be able to fly with less fuel provision in case of needing to divert and could therefore save on fuel costs and/or use the additional weight to carry more passengers, if possible.

This possibility was not examined further due to the relatively close proximity of an existing airfield at Ohakea with runway lengths of similar distance as that proposed by the runway extension, meaning any fuel and safety benefits would have already been factored in to airline procedures. Ohakea Airbase is designated as a secondary diversion airport for civilian aircraft at present,⁷⁶ but we understand that it has been used in this capacity only rarely.

In addition, the processing facilities are not sufficient to handle the volumes of passengers carried on wide-bodied aircraft, meaning that international passengers would remain on-board until either Auckland or Christchurch were available. The potential for reduced delays experienced by passengers would, in our view provide the major benefit from the proposed runway extension. However, given the apparently minor frequency with which flights have been diverted to Ohakea in the past, we assess the possible benefit to be marginal in size.

5.3 Net economic benefits

Table 29 draws together the incremental economic costs and benefits of each of the alternative project options in relation to the base case that have been outlined in the preceding sections to provide estimates of the net economic benefits of each option for the nation as a whole.

⁷⁶ https://en.wikipedia.org/wiki/RNZAF_Base_Ohakea

Table 29 Incremental net economic benefits of each option for the nation as a whole

ECONOMIC COST OR BENEFIT ITEM	OPTION 1 '\$000	OPTION 2 '\$000	OPTION 3 '\$000
Incremental economic costs for:			
• Airports	343,869	196,055	38,286
• Airlines	Assumed to be incurred by foreign airlines		
• Users	834,316	363,585	834,316
• Other sections of the community	611,630	267,841	917,213
Total incremental economic costs	1,789,815	827,481	1,789,815
Incremental economic benefits for:			
• Airports	121,744	67,582	101,487
• Airlines	5,826	2,853	0
• Users	1,601,085	705,030	874,997
• Other sections of the community	2,385,447	1,025,964	2,405,704
Total incremental economic benefits	4,114,102	1,801,430	3,382,189
INCREMENTAL NET ECONOMIC BENEFITS FOR THE NATION	2,324,287	973,948	1,592,373
Ratio of benefits to costs (BCR)	2.3	2.2	1.9
Ratio of net benefits to capital costs (NBIR)	7.6	5.4	5.2

As indicated in Table 29:

- All three options generate a positive net benefit for the nation as a whole in net present value terms.
- Option 1 generates the highest net benefit of the three options of \$2.3 billion, expressed in net present value terms.
- Option 1 also generates the highest benefit cost ratio of 2.3.

It is important to exercise caution when interpreting the benefit cost ratios for each of the options (i.e. the “simple” BCR ratios that express the present value of all benefits as a proportion of the present value of all capital and operating costs). This caution is necessary because the measure includes operating costs in the denominator which reduces the BCR by averaging the net benefits of the project over a larger investment.

Such effects are noted in paragraph 167 of the New Zealand Treasury’s Guide to Social Cost Benefit Analysis. The effects are discussed more extensively in the National Guidelines for Transport System Management (NGTSM) in Australia,⁷⁷ which outline best practice for transport planning and assessment in Australia.

To avoid these problems, Section 2.10.4 of Volume 5 of the NGTSM recommends estimating the BCR as the ratio of the present value of the benefits less the present value of the costs of the project, all divided by the present value of the investment (i.e. the PV of the capital expenditure on the project) – that is, placing operating costs in the numerator of the BCR:

The definition of BCR provided in Volume 3 places the present value of infrastructure operating costs (ongoing costs) in the numerator as a negative benefit. This differs from BCR definitions in many BCA manuals where infrastructure operating costs are added to investment costs (or capital costs) in the denominator.

Perkins (1994) defines BCR as having operating costs in the denominator and uses the term ‘net benefit investment ratio’ (NBIR) to refer to the ratio with operating costs in the

⁷⁷ Available on the Australian Transport and Infrastructure Council’s website.

numerator. According to Perkins, the BCR with operating costs in the denominator cannot be used to rank initiatives. Its only use is as an indicator of whether or not the NPV is positive. NBIR should be used to rank initiatives because only the investment costs of new initiatives are paid from the budget, not the associated operating costs. If operating costs are paid from the same budget as capital initiatives, the NBIR is still the appropriate measure for ranking initiatives, because the operating costs arising from new initiatives come from future budgets, not the currently allocated budget. The issue of future operating costs competing for scarce funds out of future budgets is addressed in detail below. The Guidelines use the BCR term for NBIR because BCR is well-known and is often defined as if it were the NBIR.⁷⁸

It is for this reason that Table 29 presents estimates of both the:

- “Simple” BCR for each option, which expresses the present value of benefits as a ratio of the present value of all costs, including operating costs, and
- NBIR for each option, which expresses the present value of the net benefits of each option as a proportion of the capital costs the option. This indicates that Option 1 generates the greatest net benefit for the nation as a whole expressed as a proportion of the capital costs of that option (i.e. a NBIR of 7.6).

Estimates of the initial distribution of the incremental net benefits arising from each of the options is outlined in Table 30 below. As noted in Table 30:

- Most of the initial net economic cost of Option 1 and Option 2 would be incurred by WIAL.
- Whereas most of the net economic benefits of each option would be derived by other sections of the community, including users of the additional outbound airline and airfreight services at Wellington Airport and other New Zealand businesses that would supply additional goods and services to the additional international visitors to Wellington Airport.

Over time, however, it is likely that the operation of the market mechanism will tend to shift at least some of this initial net benefit derived by foreign airlines back to those individuals and businesses that currently bear the actual economic incidence of the economic costs arising from the constrained length of the runway at Wellington Airport. That is, the New Zealand individuals and businesses that are the least able to avoid those costs (e.g. low income individuals and New Zealand businesses that have to compete with other domestic and international suppliers of goods and services that do not face these transport cost imposts).

⁷⁸ National Guidelines for Transport System Management in Australia (2006), Volume 5 Background Material, section 10. <https://ngtsguidelines.files.wordpress.com/2014/08/ngtsg-volume5.pdf>. <https://ngtsguidelines.files.wordpress.com/2014/08/ngtsg-volume5.pdf>. See also Perkins, F. (1994), *Practical Cost Benefit Analysis*, Macmillan, South Melbourne.

Table 30 Initial distribution of incremental net benefits

ECONOMIC COST OR BENEFIT ITEM	OPTION 1 \$'000	OPTION 2 \$'000	OPTION 3 \$'000
Net incremental economic benefits for:			
• Airports	-222,125	-128,473	63,201
• Airlines	5,826	2,853	0
• Users	766,769	341,445	40,681
• Other sections of the community	1,773,818	758,124	1,488,492
INCREMENTAL NET ECONOMIC BENEFITS FOR THE NATION	2,324,287	973,948	1,592,373
Ratio of benefits to costs (BCR)	2.3	2.2	1.9
Ratio of net benefits to capital costs (NBIR)	7.6	5.4	5.2

5.4 Possible regional effects

The CBA is focused on national-level impacts, and as such we did not undertake any specific regional analysis. Nevertheless, the possibility of significant benefit to the greater Wellington region exists. The simplest lens through which to consider regional impacts of a proposal that would increase visitor expenditure is that of a “gateway city.” Wellington is currently one of the “gateway cities” in New Zealand.⁷⁹ Such cities are characterised in terms of being the first place tourists typically visit.⁸⁰ They do not necessarily have to contain tourist attractions or be the principal destination for tourists. Gateway cities tend to account for the majority of tourist expenditure, and this has reportedly been the case for Auckland and Christchurch.⁸¹

As a means of estimating the extent of this potential regional benefit, we assume that Wellington would become more of a “gateway” to those overseas visitors who are forecast to arrive as a result of the extension. That is, we assume that following the runway extension Wellington would serve as a “gateway” in the lower part of the North Island in much the same way as Auckland does for the upper half.

We combined published data on international visitor spending by region and the arrival port for international visitors to try to estimate a possible “gateway effect.” Table 31 shows the proportion of visitor expenditure spent in the gateway (Auckland in this case), and the proportion of visitors arrivals at the gateway. By multiplying these two figures and taking the mean, we are able to determine a “weighted average gateway effect” of 31 per cent. This is a proxy for what the wider Wellington region might expect to gain as a result strengthening its “gateway” role for those tourists who now touch down first in Wellington as a result of direct flights.

Almost a third of the net benefits of visitor expenditure of between \$574m (low) and \$1.9bn (high) would be significant for the region. However, we note that China is something of an outlier in terms of expenditure in Auckland. One reason for this might be the predominance of package/tour group travel by Chinese tourists which results in different shopping/expenditure to other travel methods (i.e. more retail/duty free purchases at pre-arranged venues). To the extent that Wellington is able to match such offerings for those travellers, then the comparison between Auckland and Wellington as “gateways” is valid.

⁷⁹ <http://tourism-travel-guide.weebly.com/gateway-cities.html>

⁸⁰ <http://www.businessdictionary.com/definition/gateway-city.html>

⁸¹ http://www.nzherald.co.nz/business/news/article.cfm?c_id=3&objectid=11423766

Taking China out of the calculations results in a reduction of the “weighted average gateway effect” from 31 per cent to 25 per cent which is still regionally significant.

Table 31 Estimated “gateway effect”

Origin	Proportion of expenditure in gateway	Proportion of arrivals at gateway
Australia	32 per cent	60 per cent
China	62 per cent	91 per cent
Japan/Other Asia	43 per cent	82 per cent
US	30 per cent	78 per cent
UK	30 per cent	73 per cent

Source: Tourism New Zealand Market Visitor Profiles; Statistics New Zealand, International Visitor Arrivals to New Zealand December 2014

5.5 Comparison with other CBA studies

To provide some context, we present reported estimates of the BCR for other similar proposals. Those analyses where runway extensions have been subject to cost-benefit analyses demonstrate the wide range of BCR estimates, but in general the results are positive in all but the most pessimistic scenarios. The table also contains reported BCRs for other transport infrastructure investments in New Zealand. Some of the projects listed were funded despite comparatively modest BCRs. This is of particular relevance to projects in Wellington with complementary objectives.

Table 32 CBA Results for Other Infrastructure Projects

	BCR	Source
Waikato Airport Runway Extension	2.15	University of Waikato (2008) “ <i>Report on Proposed Runway Extension at Waikato Regional Airport.</i> ” Management Research Centre, November.
Sunshine Coast Airport Master Plan	0.20-2.85	PWC (2010) “ <i>Sunshine Coast Airport- Airport Master Plan- Update Cost-Benefit Analysis.</i> ” December.
Hilton Head Island Airport Runway Extension	1.03-2.03	Talbert, Bright and Ellington (2014) “ <i>Runway 03/21 Extension Benefit Cost Analysis Hilton Head Island, South Carolina.</i> ” Report to Beaufort County Department of Airports.

	BCR	Source
Rock County Airport Runway Extension	0.28-5.27	Economic Development Group and Flight Transportation Associates (2000) “ <i>Benefit-Cost Analysis for the Rock County Airport (JVL) Runway Extension.</i> ” Report to Wisconsin Department of Transportation Bureau of Aeronautics, September.
Nicosia Airport Runway Extension	3.7	Ody J (1969) “ <i>Application of Cost-Benefit Analysis to Airports- the Case of Nicosia, Cyprus.</i> ” Journal of Transport Economics and Policy v 111 (3), pp.322-332. Available at: http://www.bath.ac.uk/e-journals/jtep/pdf/Volume_111_No_3_322-332.pdf
<i>Wellington Roads of National Significance</i>		
Airport to Mt Victoria	0.4	Pickford (2013) “ <i>State Highway Investment in New Zealand- The Decline and Fall of Economic Efficiency.</i> ” Policy Quarterly, v 9 (3), August, pp.28-35. Table 4.
Basin Reserve flyover	2.7	
Terrace tunnel	0.5	
Aotea Quay to Ngauranga Gorge	3.2	
Ngauranga to Linden	1.8	
Transmission Gully	0.8	
Mackays to Peka Peka	0.9	
Peka Peka to Otaki	0.5	
Otaki to Levin	2.2	
<i>Other Roads of National Significance</i>		
Puhoi to Wellsford	0.8	Pickford (2013) “ <i>State Highway Investment in New Zealand- The Decline and Fall of Economic Efficiency.</i> ” Policy Quarterly, v 9 (3), August, pp.28-35. Table 3
Waikato Expressway	1.4	
Tauranga Eastern Link	1.4	
Wellington Northern Corridor	1.1	

6. Preferred option

6.1 Selection of the preferred option

As noted in Section 5.3, the results of the quantitative analysis of each option indicate that Option 1 is the preferred option out of the three options identified for detailed cost benefit analysis. The results of the qualitative analysis of the unquantified costs and benefits of each of the alternative options is also consistent with the selection of Option 1 as the preferred option.

Although Option 2 would defer the capital costs of the project, this would come at the expense of deferring the key benefits of the project as well; as a result deferral produces less substantially less net economic benefit.

Similarly, although Option 3 would avoid the need to construct an extended runway, its effectiveness and efficiency is reduced by the fact that it fails to address the fundamental sources of the problem – namely, the economic inefficiencies and inequities that arise as a result of the current constrained length of the runway at Wellington Airport.

6.2 Sensitivity analysis

As previously noted, one of the challenges facing the evaluation of infrastructure projects that have long economic lives is the presence of considerable risk and uncertainty regarding the costs and benefits of those projects.

The existence of this risk and uncertainty means that it is important to consider the extent to which the results of the cost benefit analysis are sensitive to changes in the estimated economic costs and benefits of each option. In particular, it is important to consider the extent to which that risk and uncertainty potentially alters the:

- Extent to which each option would generate a positive net benefit, expressed in net present value terms.
- Selection of the preferred option – that is, the option that is expected to generate the greatest net benefit for the nation as a whole.

Consistent with the recommendations of the New Zealand Treasury's *Guide to Social Cost Benefit Analysis*, the sensitivity of the results of the cost benefit analysis have been tested by varying the key factors that influence those results, namely the:

- Capital costs of each of the options. The AECOM estimates of the risk adjusted capital costs of the runway extension (i.e. the 95 per cent confidence estimate that includes a 20 per cent contingency, which have been estimated using Monte Carlo analysis) and the other capital costs (e.g. the capital cost of the additional Code E aircraft gates) have been increased and decreased by 10 per cent.
- Forecast numbers of additional aircraft and passengers visiting Wellington Airport. The “most likely” aircraft and passenger movement forecasts have been varied using InterVISTAS “high” and “low” forecasts of the additional aircraft movements following the runway extension.

- Real discount rate, which has been increased to 10 per cent and reduced to 3 per cent.

The results of that sensitivity analysis are set out in Table 33 and are discussed further below.

Table 33 Sensitivity of results to changes in estimated economic costs and benefits

ECONOMIC COST OR BENEFIT ITEM	OPTION 1			OPTION 2			OPTION 3		
	LOW \$'000	MOST LIKELY \$'000	HIGH \$'000	LOW \$'000	MOST LIKELY \$'000	HIGH \$'000	LOW \$'000	MOST LIKELY \$'000	HIGH \$'000
Incremental economic costs for:									
• Airports	326,449	343,869	359,303	188,160	196,055	202,965	25,686	38,286	50,920
• Airlines	0	0	0	0	0	0	0	0	0
• Users	367,843	834,316	1,760,166	113,972	363,585	773,128	367,843	834,316	1,760,166
• Other sections of the community	251,489	611,630	720,847	111,519	267,841	309,566	552,252	917,213	1,029,230
Total incremental economic costs	945,781	1,789,815	2,840,315	413,651	827,481	1,285,659	945,781	1,789,815	2,840,315
Incremental economic benefits for:									
• Airports	85,578	121,744	159,601	51,343	67,582	83,622	65,676	101,487	139,576
• Airlines	4,943	5,826	6,572	2,430	2,853	3,206	0	0	0
• Users	615,609	1,601,085	3,278,844	225,409	705,030	1,443,940	381,087	874,997	1,962,345
• Other sections of the community	829,087	2,385,447	2,856,272	350,726	1,025,964	1,205,530	848,988	2,405,704	2,876,298
Total incremental economic benefits	1,535,217	4,114,102	6,301,289	629,908	1,801,430	2,736,299	1,295,752	3,382,189	4,978,219
INCREMENTAL NET ECONOMIC BENEFIT	589,436	2,324,287	3,460,974	216,257	973,948	1,450,641	349,971	1,592,373	2,137,904
Benefit cost ratio (BCR)	1.6	2.3	2.2	1.5	2.2	2.1	1.4	1.9	1.8
INCREMENTAL NET ECONOMIC BENEFITS at:									
Different capital costs:									
• 10% higher capital costs	553,125	2,286,836	3,422,768	195,465	952,645	1,428,925	313,660	1,554,922	2,099,698
• 10% lower capital costs	625,697	2,361,579	3,498,948	237,033	995,186	1,472,252	386,232	1,629,665	2,175,878
Different real discount rates:									
• 10% real discount rate	209,378	1,234,406	1,884,847	48,822	411,080	635,013	59,714	783,505	1,079,982
• 3% real discount rate	1,948,283	6,047,847	8,862,595	1,001,393	3,270,261	4,729,061	1,424,317	4,410,649	5,848,477
BENEFIT COST RATIO (BCR) at:									
Different capital costs:									
• 10% higher capital costs	1.6	2.3	2.2	1.4	2.1	2.1	1.3	1.9	1.7
• 10% lower capital costs	1.7	2.3	2.2	1.6	2.2	2.2	1.4	1.9	1.8
Different real discount rates:									
• 10% real discount rate	1.3	2.1	2.1	1.2	1.9	2.0	1.1	1.7	1.6
• 3% real discount rate	2.1	2.6	2.4	2.0	2.5	2.3	1.8	2.1	1.9

The results of the sensitivity analysis indicate that:

- Option 1 and Option 2 still generate positive net benefits for the nation as a whole under the “low” scenario, even at a higher real discount rate of 10 per cent.
- Option 1 is still the preferred option under all of the alternative scenarios.

Further sensitivity analysis was conducted to determine whether the incremental economic benefits that existing users would derive from each of the options would be sufficient by themselves to more than offset the additional capital costs of each option, including the cost of raising taxation revenue to fund those additional capital costs (i.e. ignoring all of the other benefits generated by each of the options).

As indicated in Table 34, the results of that analysis indicate that:

- At the weighted average proportions of existing long-haul passengers use direct flights, then the benefits that they derive would be more than sufficient to offset the additional capital costs of the project under the most likely scenario for options 1 and 2.
- Even if the proportion of existing long-haul passengers and airfreight who used direct flights at Wellington Airport was 20 per cent lower, the incremental economic benefits they derive would be more than sufficient by themselves to offset the capital costs of the proposed runway extension under the “most likely” forecasts for options 1 and 2.

Table 34 Sensitivity of the net direct benefits of the project to changes in the proportion of existing users that would use direct flights

ECONOMIC COST OR BENEFIT ITEM	OPTION 1			OPTION 2			OPTION 3		
	LOW \$'000	MOST LIKELY \$'000	HIGH \$'000	LOW \$'000	MOST LIKELY \$'000	HIGH \$'000	LOW \$'000	MOST LIKELY \$'000	HIGH \$'000
Incremental direct economic costs:									
• Capital cost of extended runway	298,133	298,133	298,133	175,886	175,886	175,886	na	na	na
• Capital cost of Code E aircraft gates	2,630	7,450	10,250	1,337	3,787	5,211	na	na	na
• Capital cost of fund to promote WIA as a hub	na	na	na	na	na	na	300,763	305,583	308,383
• Cost of using general taxation revenue to fund capital costs	60,153	61,117	61,677	30,579	31,069	31,353	60,153	61,117	61,677
Total incremental direct economic costs	360,916	366,699	370,060	207,802	210,742	212,451	360,916	366,699	370,060
Incremental direct economic benefits:									
• Reductions in generalised costs for existing users	233,439	724,132	1,313,872	105,185	322,972	581,090	0	0	0
• Residual value of capital assets	19,902	20,257	20,026	23,296	23,803	23,546	19,902	20,257	20,026
Total incremental direct economic benefits	253,340	744,389	1,333,898	128,481	346,775	604,636	19,902	20,257	20,026
INCREMENTAL NET ECONOMIC BENEFIT	-107,575	377,689	963,838	-79,322	136,032	392,186	-341,014	-346,442	-350,034
Benefit cost ratio (BCR)	0.7	2.0	3.6	0.6	1.6	2.8	0.1	0.1	0.1
INCREMENTAL NET ECONOMIC BENEFITS at:									
Different proportion of use of direct flights:									
• 20% greater use of direct flights by existing users	-60,888	522,516	1,226,613	-58,285	200,627	508,404	-341,014	-346,442	-350,034
• 20% lower use of direct flights by existing users	-154,263	232,863	701,064	-100,358	71,438	275,968	-341,014	-346,442	-350,034
BENEFIT COST RATIO (BCR) at:									
Different proportion of use of direct flights:									
• 20% greater use of direct flights by existing users	0.8	2.4	4.3	0.7	2.0	3.4	0.1	0.1	0.1
• 20% lower use of direct flights by existing users	0.6	1.6	2.9	0.5	1.3	2.3	0.1	0.1	0.1

The sensitivity of the results of the analysis was also tested to changes in the assumptions regarding the net benefit gained by New Zealand from the supply of additional goods and services to international visitors to New Zealand under each of the options. We used net benefit figures of 80 per cent and 10 per cent. For completeness we also include our original estimate of 45.9 per cent.

As indicated in Table 35, it is estimated that:

- Option 1, the preferred option, still generates significant net benefits and a BCR of 1.3 even when it is assumed that the value added by New Zealand businesses supplying additional goods and services to international tourists is only 10 per cent of the value of those additional sales.
- Option 1 is still the preferred option under each of these alternative scenarios.

Table 35 Sensitivity of the net benefits of each option to changes in the value added by New Zealand businesses that supply additional goods and services to international visitors

ECONOMIC COST OR BENEFIT ITEM	OPTION 1			OPTION 2			OPTION 3		
	LOW \$'000	MOST LIKELY \$'000	HIGH \$'000	LOW \$'000	MOST LIKELY \$'000	HIGH \$'000	LOW \$'000	MOST LIKELY \$'000	HIGH \$'000
Incremental economic costs for:									
• Airports	326,449	343,869	359,303	188,160	196,055	202,965	25,686	38,286	50,920
• Airlines	0	0	0	0	0	0	0	0	0
• Users	367,843	834,316	1,760,166	113,972	363,585	773,128	367,843	834,316	1,760,166
• Other sections of the community	251,489	611,630	720,847	111,519	267,841	309,566	552,252	917,213	1,029,230
Total incremental economic costs	945,781	1,789,815	2,840,315	413,651	827,481	1,285,659	945,781	1,789,815	2,840,315
Incremental economic benefits for:									
• Airports	85,578	121,744	159,601	51,343	67,582	83,622	65,676	101,487	139,576
• Airlines	4,943	5,826	6,572	2,430	2,853	3,206	0	0	0
• Users	615,609	1,601,085	3,278,844	225,409	705,030	1,443,940	381,087	874,997	1,962,345
• Other sections of the community	829,087	2,385,447	2,856,272	350,726	1,025,964	1,205,530	848,988	2,405,704	2,876,298
Total incremental economic benefits	1,535,217	4,114,102	6,301,289	629,908	1,801,430	2,736,299	1,295,752	3,382,189	4,978,219
INCREMENTAL NET ECONOMIC BENEFIT	589,436	2,324,287	3,460,974	216,257	973,948	1,450,641	349,971	1,592,373	2,137,904
Benefit cost ratio (BCR)	1.6	2.3	2.2	1.5	2.2	2.1	1.4	1.9	1.8
INCREMENTAL NET ECONOMIC BENEFITS at:									
Different proportion of value added by NZ businesses:									
• 80% value added	627,704	2,434,390	3,592,808	232,445	1,021,303	1,506,283	388,239	1,702,476	2,269,738
• 45.9% value added	366,720	1,683,489	2,693,699	122,042	698,346	1,126,802	127,255	951,576	1,370,629
• 10% value added	91,961	892,952	1,747,131	5,812	358,341	727,289	-147,504	161,038	424,061
BENEFIT COST RATIO (BCR) at:									
Different proportion of value added by NZ businesses:									
• 80% value added	1.7	2.4	2.3	1.6	2.3	2.2	1.4	2.0	1.8
• 45.9% value added	1.3	1.7	1.7	1.2	1.6	1.7	1.1	1.4	1.4
• 10% value added	1.1	1.3	1.4	1.0	1.2	1.4	0.9	1.0	1.1

7. Implementation of the preferred option

7.1 Funding the preferred option

The estimates presented above (including the sensitivity analyses) assumed, for simplicity, that all of the additional capital costs under each option would be funded through general taxation revenue. This section examines whether alternative approaches to funding would alter the selection of Option 1 as the preferred option and how alternative funding options might affect the estimates of benefits and costs. The CBA does not consider who should pay for the runway extension, as our focus is on national and regional economic benefit. More detailed financial analysis would be required for a business case or funding proposal.

7.2 Alternative approaches to funding

There are at least three possible approaches to funding the additional capital costs of the preferred option:

- Government revenue (e.g. New Zealand Government taxation revenue or Wellington City and Regional Council revenue).
- Increase user charges at Wellington Airport.
- Some combination of government revenue and increased user charges (e.g. sharing the additional capital costs of the project between the New Zealand Government, the Wellington City and Regional Councils and users of airline services at Wellington Airport).

These options could conceivably give rise to different impacts on economic efficiency and distributional equity.

7.2.1 Assume Government revenue funding

Using the tax system – central or local government taxes – to raise revenue introduces economic distortions; economists refer to these distortions as “deadweight costs” as the distortions are a cost to the economy.⁸² In general, the magnitude of the burden imposed on the economy depends on the rate of the tax and the sensitivity of behavioural responses to any differential imposition of the tax. Thus, the particular instruments used to raise the tax are an important determinant of the economic cost of taxation.

⁸² Diewert E and D Lawrence (1994) “*The Marginal Costs of Taxation in New Zealand.*” Report to the New Zealand Business Roundtable. Available at: http://nzinitiative.org.nz/site/nzinitiative/files/The_per_cent20Marginal_per_cent20Costs_per_cent20of_per_cent20Taxation_per_cent20in_per_cent20New_per_cent20Zealand.pdf

In recent decades, the New Zealand Government has sought to reduce the deadweight costs of taxation through broadening the tax base (e.g. GST) and lower rates of tax. In practice, however, potential conflicts between equity and efficiency objectives and a paucity of information on which to design “optimal” tax systems act to limit the scope for reducing the deadweight costs of taxation. Hence, the New Zealand Treasury recommend a 20 per cent increase in projects costs should be factored in for projects funded by general tax revenue to account for these economic efficiency costs – this is the approach adopted in the estimated costs and benefits reported in this paper.

Very little information is available regarding the deadweight costs arising from the use of local government rates. It is possible that local government rates could raise revenue more efficiently than either income or consumption taxes to the extent as taxes on relatively immobile factors of production (e.g. land) are the primary tax base for local government.⁸³

However, there is a risk that local authority rates may impose higher deadweight costs on the nation as a whole than general taxation revenue. Local government has considerable discretion in how it sets rates and may not design its rating regime with economic efficiency in mind. A council’s tax base is also much narrower than the New Zealand Government’s income and consumption tax base. Raising the same amount of revenue over a smaller tax base necessarily involves higher rates and hence potentially greater distortions in relative prices and rates of return.

In the absence of specific funding proposals, and with limited information on the deadweight costs of local government revenue-raising, the New Zealand Treasury recommendation of a 20 per cent loading for central government funded projects would seem the best proxy for the economic costs of local government funding. On this basis, altering the assumption of government funding to local government funding or some combination of local and central government funding would not change the results reported in this report.

7.2.2 Assume an increase in user charges

An alternative approach to estimating the economic costs and benefits of the proposal would be to assume it were funded by an increase in user charges. If this increase in fees were paid by existing users of Wellington Airport, it would necessarily mean a charge which exceeds the economic cost of supplying those services (assuming current charges reflect the full economic cost of the existing service). An amount which exceeds the full economic cost of a good or service is economically equivalent to a tax.

Hence, as with funding from taxation revenue, funding through fees in charges would give rise to deadweight losses. The magnitude of the economic costs of raising additional revenue using any tax, including user charges that are higher than the social marginal costs of supplying those services, are greater the:

⁸³ Recent and previous reports have assessed the New Zealand system of property rates as a relatively efficient means of funding local government – see for example ‘Independent Inquiry into Local Government Rates’ 2006, and Local Government New Zealand’s Local Government Funding Review, 2015.

- Higher rate of the tax and the value of economic decisions that are potentially affected by the tax (i.e. the size of the tax base);
- Greater the extent to which that tax unintentionally distorts the relative prices of goods and services to consumers and the relative rates of return to suppliers of goods and services, and
- Greater the sensitivity of those economic decisions to those tax-induced distortion in relative prices and rates of return (i.e. the greater the own price elasticities of demand and supply of those goods and services), which will also be influenced by the nature and extent of competition at Wellington airport.

WIAL has improved the economic efficiency of airport user charges at Wellington Airport (e.g. through the introduction of time of day charges to reduce congestion costs). However, there is no guarantee that WIAL's existing system of user charges would be capable of raising the revenue required to fund the additional capital costs of the project at a lower cost to the nation as a whole than would New Zealand's tax system. If the capital cost of the proposed runway extension was funded by increasing all aircraft movement charges, then the initial legal incidence of the tax would be spread over a much smaller number of "taxpayers" (i.e. airlines using Wellington Airport) and tax base (i.e. aircraft using Wellington airport) than would be the case if the project was to be funded from general taxation revenue or local government rates. That is, the rate of the tax would have to be higher than it would if the runway extension was funded through either general government revenue or council rates, since the tax base to which it is applied would be much smaller.

All else equal, higher airport charges would reduce demand for airport services at Wellington to a level below that which would otherwise have prevailed in the absence of those higher charges (i.e. if the capital costs of the project had been funded from general taxation revenue instead).

Overall, to increase the net benefits that the nation as a whole derives from an extension of the runway at Wellington Airport, the "deadweight costs" associated with using the revenue from airport user charges to fund the capital costs of that extension would have to be sufficiently lower to offset the extent to which the lower aircraft and passenger number using Wellington Airport would reduce the net benefits from the project.

7.2.3 Assume a combination of government revenue and increased user charges

Another possible approach to funding would be to spread the additional costs across all three of the funding parties mentioned (i.e. ratepayers, taxpayers and airport users). Such a cost sharing approach has the potential to:

- Improve the perceived equity of the funding arrangements to the extent that it would spread the initial legal incidence of the additional capital costs of the project over all sections of the community that are expected to benefit from the project.
- Reduce the economic cost of raising the revenue required to fund the additional capital costs of the project to the extent that:
 - The "tax base" would be much broader than under the other funding approaches considered.

- The rates of additional tax imposed on taxpayers, ratepayers and airport users under this option are lower than they would be if revenue was collected from one source.

It is conceivable that a mixed funding approach could be designed in such a way as to fund the project at lower economic cost than the 20 per cent loading assumed in our analysis. However, as the details of funding are still to be determined, we consider it prudent to retain this 20 per cent assumption when assessing the economic costs and benefits of the proposed runway extension.

7.3 Incentives to airlines

WIAL currently provides incentives for airlines establishing new routes to Wellington, and the media recently reported that Wellington City Council has provided an incentive to Singapore Airlines in establishing its new Wellington, Canberra, Singapore route. These incentives are a form of mixed funding approach (e.g., the incentive paid by the Wellington City Council is funded from rates). The costs of the incentive are therefore considered in the analysis described above. We make no adjustment to the InterVISTAS forecasts to allow for any supply response from airlines to the incentives.

Appendix 1: Background and context

Background

Wellington International Airport (“Wellington Airport”) is located on a constrained site of 110 hectares of land in Rongotai, a residential suburb within eight kilometres of the centre of Wellington City. As a result, the airport only has a single runway, bounded by water at either end.

Up until 1990, the airport was owned and operated as an airport authority under a joint venture agreement between the Crown and the City of Wellington, after which it was corporatised by the Wellington Airport Act 1990 and partly privatised in 1998.

The airport is now owned and operated by Wellington International Airport Limited (“WIAL”), which is owned by:

- Infratil Limited, which now wholly owns New Zealand Airports Limited, which purchased the Crown’s 66 per cent shareholding. Infratil is an NZX listed company that has around 16,000 predominantly New Zealand resident shareholders, and
- Wellington City Council, which holds the remaining 34 per cent of the shares in WIAL.

Airline usage

The airport is used by a total of 11 airlines, six of which provide international services (Air New Zealand, Fiji Airways, Jetstar, Qantas, Singapore Airlines, and Virgin Australia).⁸⁴ Further information on the international carriers is contained in the table below. Domestic services are provided by Air New Zealand, Jetstar Air Chathams, Golden Bay Air, Origin Air and Sounds Air, while Inflight offers charter services only.

Airline	Headquarters	Ownership structure
Air New Zealand	Wynyard Quarter, Auckland	Publicly listed company, majority-owned by New Zealand Government (53 per cent)
Fiji Airways	Nadi International Airport, Nadi, Fiji	Part of Air Pacific Group, which is 51 per cent owned by Fiji Government, Qantas owns 46.32 per cent while Air New Zealand and the governments of Kiribati, Tonga, Nauru and Samoa hold minor stakes ⁸⁵

⁸⁴ This includes the recently announced Singapore Airlines flight from Wellington to Canberra to Singapore.

⁸⁵ https://en.wikipedia.org/wiki/Fiji_Airways

Airline	Headquarters	Ownership structure
Jetstar Airways	Melbourne, Australia	Wholly owned by Qantas Group ⁸⁶
Qantas	Mascot, New South Wales, Australia	Publicly listed, though foreign ownership restricted to 49 per cent by legislation. Substantial shareholders as at July 2014 include J P Morgan Nominees Australia Ltd (25.33 per cent), HSBC Custody Nominees Ltd (21.87 per cent), and National Nominees Ltd (13.98 per cent) ⁸⁷
Singapore Airlines	Singapore	Owned by the Singapore Government
Virgin Australia	Bowen Hills, Brisbane, Australia	Air New Zealand (23 per cent), Singapore Airlines (20 per cent) and Etihad (20 per cent) were major stakeholders (as at December 2013) ⁸⁸

⁸⁶ <http://www.jetstar.com/nz/en/about-us/our-company>

⁸⁷ <http://qantas2014.reportonline.com.au/shareholder-information>

⁸⁸ <http://www.ausbt.com.au/virgin-australia-air-new-zealand-etihad-singapore-airlines-take-bigger-stake>

Appendix 2: Information sources

CBA Guidance

The approach adopted in this report to evaluate the economic costs and benefits of each of the alternative options has drawn on the following guidelines:

- New Zealand Treasury's '*Guide to Social Cost Benefit Analysis*'.
- New Zealand Transport Agency '*Economic evaluation manual*'.
- Australian Government Civil Aviation Safety Authority '*Cost benefit Analysis Procedures Manual*'.
- United States of America Federal Aviation Administration '*FAA Airport Benefit-Cost Analysis Guidance and Economic Values for FAA Investment and Regulatory Decisions, A Guide*'.
- United Kingdom Government, Department for Transport '*Transport Analysis Guide TAG Unit A5.2, Aviation Appraisal*'.
- C E Delft '*The Economics of Airport Expansion*'.

Independent inputs

- *Financial information* – Information on the nominal annual capital and operating costs, including risk adjusted costs, for the base case and Option 1 were obtained from WIAL and were prepared by AECOM. These estimated nominal costs were then adjusted to estimate the real economic costs of implementing both Option 1 and Option 2.
- *Demand forecasts* – information on the forecasts of the baseline passenger and aircraft movements for Wellington Airport and the estimated impact on these measures as a result of the runway extension were provided by InterVISTAS Consulting Limited, international aviation specialists.
- *Aircraft performance data* – specialist advice was sort from Astral Aviation consultants on the extent to which the extended runway would allow existing carriers to carry additional passenger and/or airfreight loads which are not possible given the current runway length and the potential for fuel savings from the greater runway length altering thrust settings used.
- *Environmental and other impacts* – Information on the expected effects on noise (both during construction and operation of the runway extension), landscape, urban design, archaeological, cultural, recreational uses, and ecological environment were conducted by a range of parties.

Appendix 3: Net benefits that New Zealand businesses derive from supplying additional goods and services to international visitors

As discussed in Section 1.4 of this report, in view of the uncertainty surrounding the incremental economic cost of, and hence the net benefits that New Zealand businesses derive from, supplying additional goods and services to the additional international tourists that are forecast to visit Wellington and New Zealand as a result of the runway extension:

- The “headline” net benefits and BCR for each option have been estimated under the assumption that the net economic benefit that New Zealand businesses derive from supplying these additional goods and services to international visitors is equal to 75 per cent of the value of the goods and services supplied (i.e. the economic cost of supplying those additional goods and services is 25 per cent of the value of the goods and services supplied), which is the assumption recommended by MBIE in its draft Post-Event Economic Evaluation Guidelines.⁸⁹
- The sensitivity of the results of the analysis to varying this assumption has been tested over the range from 80 per cent to 10 per cent of value of the goods and services supplied.

This appendix outlines the rationale underlying this approach. Specifically, it:

- Considers the net economic benefit that a New Zealand business would derive, in theory, from supplying additional units of a particular good or service to international visitors in both the:
 - Short run, when that business has limited flexibility to alter the scale of their activities to meet that increase in demand, and
 - Longer run, when that business has limited flexibility to alter the scale of their activities to meet that increase in demand.
- Discusses the implications of the results of that analysis for the approach adopted to estimating the net benefits that New Zealand businesses derive from supplying additional goods and services to international visitors. In particular, it notes:
 - That financial accounting and national account data may not provide accurate estimates of the additional net benefits that New Zealand businesses would derive from supplying additional goods and services to the additional international visitors that are forecast to arrive in Wellington as a result of the runway extension;

⁸⁹ Ministry of Business Innovation and Employment (2013), *Post-Event Evaluation Guidelines*, Final draft for feedback. <http://www.majorevents.govt.nz/pdf-library/resource-bank/post-event-reporting/post-event-economic-evaluation-guidelines-320-kb-pdf>

- The need to adopt a consistent approach across projects to estimating the net benefits that New Zealand businesses derive from supplying goods and services to international visitors (i.e. the approach recommended by MBIE in its draft guidelines, pending the release of its final guidelines), and
- The need to conduct sensitivity analysis to test the extent to which the “headline” results of the cost benefit analysis are sensitive to changes in this underlying assumption regarding the net benefit arising from the supply of additional goods and services to international visitors.

Net benefit that a New Zealand business derives from supplying additional goods and services to international visitors

Net benefit in the short run

Consider first the net benefit (i.e. additional “producer surplus”) that a New Zealand business would derive in the short run from supplying additional goods and services to the additional international visitors that are forecast to visit New Zealand each year as a result of the runway extension.

This is illustrated in Figure 16 below.

In particular, Figure 16 illustrates the:

- Gross economic benefit that the business derives from supplying a particular quantity of the good or service. In particular, it is assumed for the purposes of this appendix that:
 - Initially (i.e. before the runway extension), the prevailing market price of the particular good or service supplied by the business is P_1 (i.e. it is assumed that the business in question is small and is a “price taker” – that is, the quantity of the good or service it supplies does not affect the market price of that good or service).
 - Following the extension of the runway, the prevailing market price that the business receives for each unit of the particular good or service it produces increases over time from P_1 to P_2 as a result of the increase in demand for that good or service from the additional international visitors that are forecast to arrive in Wellington as a result of the runway extension.
- Gross economic cost that the business has to incur in order to supply the particular good or service in question. Specifically, Figure 16 illustrates the:
 - Short run average fixed cost (i.e. SRAFC, which is the total fixed costs that the business has to incur divided by the number of units of the particular good or service it supplies). These short run fixed costs are the unavoidable “sunk” costs that the business has had to incur, even if they do not produce any units of the good or service (e.g. the cost of physical capital, such as machinery and equipment, as well as human capital, that the business has to acquire in order to be able to supply the good or service).

- Less the additional incremental costs that the business has to incur in order to supply those Q_1 units of the good or service (i.e. the dark yellow area B under the short run marginal cost curve $SRMC_2$ over the range of output from 0 to Q_1 units). These additional incremental or short run “marginal” costs:
 - Include the “avoidable” costs that the business must incur in order to provide Q_1 units of the particular good or service. These avoidable costs typically include the variable cost of purchasing the material inputs that it requires to produce those units of output;
 - But exclude the “unavoidable” sunk costs that the business has to incur even if it did not produce any units of the particular good or service. These unavoidable costs typically include the “fixed” physical capital costs (e.g. the costs associated with purchasing or leasing a suitable building over a particular term) and fixed human capital costs (e.g. minimal numbers of employees) that the business has had to incur regardless of the number of units of the particular good or service it supplies.

That is, in the short run, before the construction of the extended runway, the business is deriving an initial net benefit or producer surplus from supplying existing quantities of goods and services to New Zealand residents and international visitors that is equal to the darker green shaded area A in Figure 16, which is equal to:

- The sunk fixed costs associated with supplying the particular good or service, which are equal in value to the darker green shaded area A in Figure 16 (which are also equal in value to the rectangular area P_1stu in Figure 16);
- Plus any economic profit that the business derives from supplying Q_1 units of the good or service, which is assumed initially to be zero (i.e. it is assumed that initially the prevailing market price P_1 is equal to the “break even” price that the business has to incur in order to recover all avoidable variable costs as well as all unavoidable sunk fixed costs, which include a normal rate of return on its investment).

As previously noted, however, by reducing the generalised cost of travelling to New Zealand, the proposed runway extension is expected to:

- Increase the number of international visitors that are expected to visit Wellington each year, and
- Thereby increase the quantity of goods and services that those additional international visitors purchase from New Zealand businesses, which is assumed to increase the prevailing market price of the particular good or service supplied by the business from P_1 to P_2 .

In response to this increase in the prevailing market price in the short run, the business will derive a net benefit from continuing to expand the quantity of the good or service they supply up until the point where the additional revenue (i.e. marginal revenue) they derive from supplying an additional unit of the good or service is equal to the additional cost of supplying that additional unit of the good or service (i.e. marginal cost), which occurs at a level of output of Q_2 (i.e. up to the point where $SRMC$ is equal to marginal revenue, which is equal to P_2).

At that new higher quantity of output of the good or service Q_2 , the business will derive a net economic benefit or producer surplus in the short run that is equal in value to the sum of the areas A and B in Figure 16, which is equal in value to:

- The sunk fixed costs associated with supplying the particular good or service, which are equal in value to the rectangular area vwxy in Figure 16.
- Plus any economic profit that the business derives from supplying Q_2 units of the good or service, which is equal in value to the rectangular area P_2zwv in Figure 16.

That is, by supplying $Q_2 - Q_1$ additional units of the particular good or service to international visitors, the business derives an additional net benefit or additional producer surplus that is equal in value to the light green shaded area C in Figure 16 (i.e. the producer surplus arising from the supply of Q_2 units of the good or service, which is equal in value to area $A + C$, less the producer surplus arising from the supply of Q_1 units, which is equal in value to the area A in Figure 16).

The magnitude of the overall net benefit that all New Zealand businesses derive from the supply of additional goods and services to international visitors each year will therefore be equal to the sum of the net benefit (i.e. producer surplus) that each New Zealand business derives from supplying those additional goods and services, which will of course vary significantly across New Zealand businesses.

In general, the greatest net benefits are likely to be derived by those businesses and industries that specialise in the supply of goods and services to international visitors, particularly those travelling through Wellington. By contrast, other New Zealand businesses may derive little or no additional benefits from the proposed runway extension.

Some indication of the overall significance of the runway extension to the sales of goods and services by New Zealand businesses can be gained by comparing the forecast increases in the value of additional goods and services that are expected to be supplied to international visitors each year (i.e. ranging from less than \$100 million in the initial years of the analysis up to around \$500 million in the final year of analysis) against the:

- Total value of retail sales of goods and services by New Zealand businesses each year (i.e. around \$58 billion in 2015).⁹⁰
- Total value of sales of goods and services supplied by New Zealand businesses to tourists each year (i.e. around \$29.8 billion in 2015).
- Total value of goods and services supplied by New Zealand businesses to international tourists each year (i.e. around \$11.8 billion in 2015).

Overall, such a comparison indicates that although the proposed runway extension is forecast to increase international visitor expenditure by around \$100 million to \$500 million each year over the period of analysis, this only constitutes only a relatively small proportion of the total value of goods and services supplied by New Zealand businesses to all

⁹⁰ Retail Trade sales by industry in current prices, Annual March year:
<http://www.stats.govt.nz/infoshare/ViewTable.aspx?pxID=8fc9ce21-63f6-418d-b296-1e6ef52d0504>

consumers (i.e. 0.2 per cent to 0.9 per cent), to all tourists (i.e. 0.3 per cent to 1.7 per cent), and to international tourists in 2015 (i.e. 0.9 per cent to 4.2 per cent).

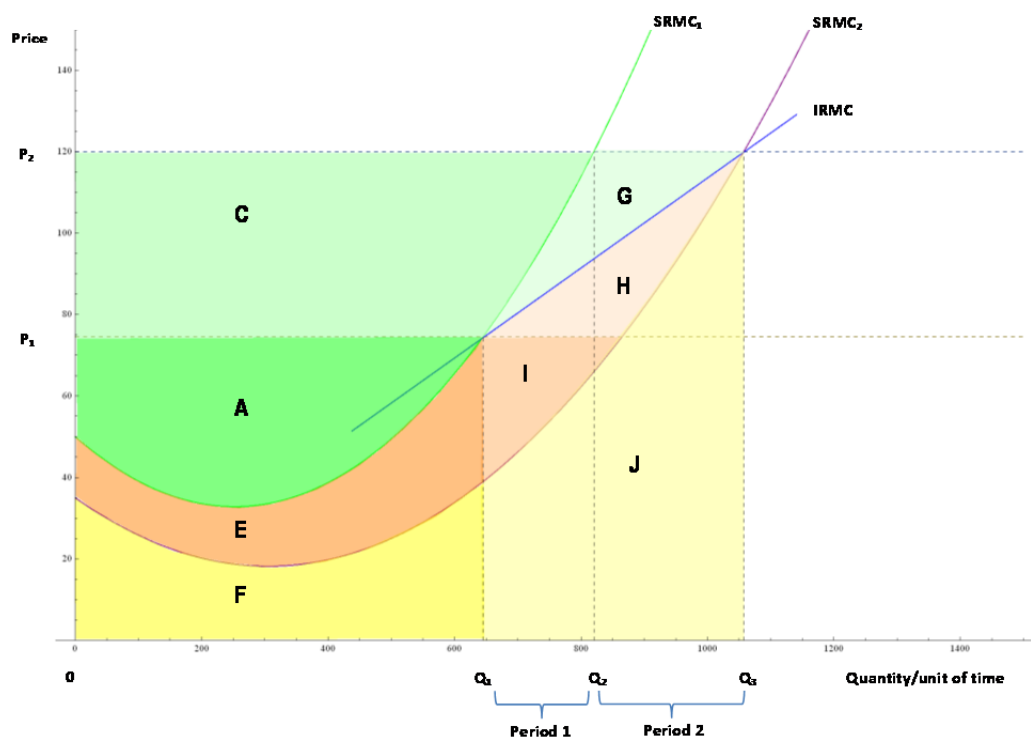
Net benefit in the longer run

Now consider what happens in the longer run when the business, and other New Zealand businesses, have the flexibility to alter a greater proportion of costs that were “unavoidable” in the short term (i.e. in the longer run when a greater range of fixed costs are “avoidable”).

This situation is illustrated in Figure 17 below, which is a modified version of Figure 16 that:

- Omits the short run average fixed cost, average variable cost and average total cost functions for simplicity (i.e. SRAFC, SRAVC, SRATC are omitted); and
- Includes the:
 - Short run marginal cost function (i.e. the SRMC function in Figure 16 is the $SRMC_1$ function in Figure 17).
 - Short run marginal cost for the business in the next subsequent “short run” period of the analysis (i.e. the $SRMC_2$ function in Figure 17).
 - Intermediate run marginal cost function for the business over the first and second short run periods of analysis (i.e. IRMC, which traces out the firm’s production adjustment possibilities over the two short run periods as it expands its output from Q_1 to Q_2 units of output in response to an increase in the market price of that good or service over those two periods from P_1 to P_2).

Figure 17 Additional producer surplus derived by the business in the longer run



Source: Adapted from Just, Hueth and Schmitz (2004), Figure 4.11, p70.

As previously noted, in the short run (i.e. in the first short run period of analysis), the net benefit that the business derives from supplying $Q_2 - Q_1$ additional units of the good or service is equal in value to the light green shaded area C in both Figure 16 and Figure 17.

By the time the second period of analysis commences, however, both the business and other New Zealand businesses will have had time to adjust some of their fixed factors of production (e.g. their level of investment in certain items of physical and human capital), as well as their production processes (e.g. the production technologies they use), in order to supply the additional goods and services demanded by the additional international visitors that are forecast to arrive in Wellington as a result of the runway extension.

This is illustrated in Figure 17 by the shift to the right in the short run marginal cost function from $SRMC_1$ to $SRMC_2$, which reflects the ability of the business by the commencement of the second period to supply a greater quantity of output at any given price as a result of their increase in investment and improvements in efficiency.

As noted by Just, Hueth and Schmitz (2004),⁹¹ the net benefit or additional producer surplus that the business derives in the second period of analysis is equal in value to the area $C+G+H+I+E$ in Figure 17, which is equal to the:

- Producer surplus that the business derives from supplying Q_2 units of the good or service, which is equal to the area $A+C+G+H+I+E$;
- Less the net benefit that the business would have derived had the business not increased the quantity of the good or service it provides in response to the increase in its price, which is equal in value to the area A in Figure 17.

This implies, as the authors note, that the correct measure of the net benefit or additional producer surplus that the business derives in the second period of analysis, as viewed from the beginning of the first period of analysis, is equal in value to the area C+G in Figure 17, which is equal to the:

- Increase in total receipts (i.e. the area $C+G+H+I+J$);
- Less the additional avoidable economic costs of the business supplying $Q_2 - Q_1$ additional units of the particular good or service (i.e. the area $H+I+J$, which is the area under the $IRMC$ function over the range of output from Q_1 to Q_3 units of output).

As a result, the correct measure of the net benefit the business derives over the two time periods is equal to the sum of the producer surpluses over variable lengths of time since the beginning of the first period of analysis. That is, it is equal in value to the:

- Producer surplus that the business derives in the first period of analysis from the commencement of that first period of analysis (i.e. area C), which requires the use of the short run marginal cost function for the first short run period (i.e. $SRMC_1$, which is the supply curve for the business in the first period of analysis – that is, the “one period” supply curve for the business) to determine the avoidable costs of supplying Q_2 units of the good or service;

⁹¹ Just R.E., Hueth D.L. and A. Schmitz (2004), *The Welfare Economics of Public Policy: A Practical Approach to Project and Policy Evaluation*, Section 4.7 Investment and Intertemporal Welfare Measurement, pp 70-74.

- Plus the additional producer surplus that the business derives in the second period of analysis, as viewed from the beginning of the first period of analysis (i.e. area C+G), which requires the use of the intermediate run marginal cost function (i.e. IRMC, which is the supply curve for the business over the two periods of analysis – that is, the “two period” supply curve for the business) to determine the additional avoidable costs associated with supplying an additional $Q_2 - Q_1$ units of the good or service.

As noted by the authors, another alternative yet arithmetically equivalent approach to calculating the net benefits that a business would derive over the two periods of analysis involves:

- Summing the changes in short run producer surpluses (i.e. area C+G+H+I+E in Figure 17), and
- Deducting the cost of the additional investment required to expand output from Q_1 to Q_3 units of the good or service (i.e. area H+I+E in Figure 17), which is equal in value to:
 - Total additional costs of expanding output from Q_1 to Q_3 units of the good or service (i.e. area H+I+J in Figure 17, which is the area under the IRMC function over the range of output from Q_1 to Q_3), which includes both additional variable costs, as well as additional investment costs;
 - Less the additional short run variable costs of expanding output from Q_1 to Q_3 (i.e. area J less area E in Figure 17), which is equal in value to:
 - (i) The variable costs associated with supplying Q_3 units of the good or service (i.e. area J+F in Figure 17).
 - (ii) Less the short run variable costs associated with initially supplying Q_1 units of the good or service (i.e. area E+F in Figure 17).

Indeed, Just, Hueth and Schmitz (2004) show that, for any general time horizon, the net producer welfare change can be accurately measured by the sum of changes in short-run producer surpluses, minus the sum of changes in investment over the entire time horizon that is required to supply those additional units of output.

Overall implications for the measurement of the net benefits New Zealand businesses derive from the additional goods and services they supply to international visitors

The results of the analysis outlined above have a number of important implications for the estimation of the net benefits that New Zealand businesses are expected to derive from supplying additional goods and services to the additional international visitors that are forecast to come to New Zealand as a result of the proposed runway extension.

In particular, as discussed further below, it means that:

- Financial, SNA and TSA data may not provide a reliable guide as to the additional net benefits that New Zealand businesses would derive from the supply of additional goods

and services to the additional international visitors that come to New Zealand as a result of the runway extension.

- In order to ensure that decision makers are able to compare the relative merits of alternative projects requiring government funding, there is a need to use a consistent approach to estimating the net benefits that New Zealand businesses derive from supplying goods and services to international visitors.
- In view of the considerable uncertainty surrounding the net benefits arising from the supply of additional goods and services to international visitors, there is also a need to test the extent to which the “headline” results of the cost benefit analysis are sensitive to changes in this underlying assumption regarding the net benefit arising from the supply of additional goods and services to international visitors.

Financial and national account data may not provide a reliable guide as to the additional net benefits derived by New Zealand businesses

Although it is possible to outline, in theory, the methodology that should be used, and information that is required to estimate the net benefits that New Zealand businesses would derive from supplying additional goods and services to the additional international visitors that are forecast to arrive in Wellington as a result of the runway extension, it is much more difficult to obtain that information in practice.

In particular, to calculate those net benefits, information is required on both the:

- Net benefit (i.e. additional producer surplus) that each business derives in each short term period of analysis, which requires information on both the:
 - Gross value of additional goods and services that are supplied by New Zealand businesses to international visitors as a result of the runway extension, and
 - Additional variable costs that each New Zealand business has to incur to supply the additional goods and services that are purchased by additional international visitors that arrive in Wellington each year as a result of the runway extension (i.e. the “marginal cost” of supplying those additional goods and services).
- Additional costs of investment that each of these businesses has to incur in the longer run in order to supply additional goods and services (e.g. the cost of purchasing additional physical and human capital).

In practice, however, such detailed information is not readily available.

As a result, it is necessary to rely on other, potentially less accurate, sources of information, such as:

- Existing financial accounting data for businesses involved in the provision of goods and services to international visitors.
- National account data (i.e. data from the System of National Accounts, or “SNA”).
- Subsets of that national accounting data, such as the New Zealand Tourism Satellite Account data (i.e. the “TSA” that are prepared from SNA data).

Unfortunately, the use of such data can result in inaccuracies in the estimation of both the additional economic costs, and hence the net benefits, that New Zealand businesses and the

nation as a whole would derive from supplying additional goods and services to the additional international tourists that are forecast to visit Wellington as a result of the runway extension.

For example, consider the effect of an approach to estimating the net benefits that New Zealand businesses derive from supplying additional goods and services to the additional international tourists that are forecast to visit Wellington each year as a result of the runway extension that involves:

- Estimating the net benefit that New Zealand businesses derive in each of the “short run” periods of analysis (i.e. each year over the period of analysis) by calculating the difference between the:
 - Gross value of output of the additional goods and services supplied to the additional international tourists that are forecast to visit New Zealand as a result of the runway extension, and
 - Economic cost of supplying those additional goods and services using TSA data on the cost of material inputs and labour costs (i.e. employee compensation), and
- Deducting the cost of the additional investment expenditure that businesses have to incur in the longer term to supply those additional goods and services, using national account data. So long as these additional investment costs are included in the cost benefit analysis (e.g. by taking these additional investment costs into account when determining the proportion of the gross value of the additional goods and services supplied constitutes a net benefit to New Zealand), it is not necessary to deduct the economic cost of the amount of these fixed assets that are used up each year in order to supply these additional goods and services, since such economic depreciation is already taken into account in the real discount rate (i.e. the real discount rate reflects the “user cost of capital”, which is equal to the sum of the Return on Investment required to recover the opportunity cost of capital, plus the Return of Capital required to compensate the investor for the value of their assets that are used up each year over the period of analysis). This is, of course, the reason why best practice cost benefit analysis guidelines indicate that the depreciation should not be deducted, since it has already been taken into account in the real discount rate. To do so would result in economic depreciation being taken into account twice in the analysis, which would understate the net benefit.

It is important to note that the approach outlined above will tend to underestimate the net benefit that New Zealand businesses would derive from the supply of those additional goods and services in both the short and longer run to the extent that those businesses would have had to incur some of the costs of additional investment in physical capital even if they did not expect to supply any additional goods and services to the additional international tourists that visit Wellington as a result of the runway extension.

For example, in the short run (i.e. in any one year over the period of analysis used for the purposes of this report), most businesses will have to incur fixed costs that are unavoidable (i.e. the business would have had to incur those costs even if they supplied no additional goods and services to the international tourists that are forecast to visit Wellington as a result of the runway extension). If all of these fixed capital costs are deducted from the gross value of additional goods and services supplied by New Zealand businesses, then this will understate the net benefit (i.e. additional producer surplus) that New Zealand businesses

would derive in the short run from supplying additional goods and services to international visitors.

Similarly, such an approach also has the potential to underestimate the net benefits that New Zealand businesses derive in the longer term to the extent that it overestimates the cost of additional investment that those businesses have to incur in order to supply the additional goods and services consumed by the additional international tourists that are forecast to visit Wellington as a result of the runway extension. Although it is possible to estimate the “average” amount of investment that has been required to supply additional goods and services in the past, there is no guarantee that this will provide a reliable guide as to the amount of additional investment that will be required by New Zealand businesses to supply the additional goods and services supplied to the international tourists that are forecast to visit Wellington as a result of the runway extension.

This is because the extent to which New Zealand businesses will have to undertake additional investment to supply the additional goods and services consumed by the additional international tourists visiting Wellington as a result of the runway extension will depend on a range of factors including the:

- Value of additional goods and services that are estimated to be purchased each year by the additional international tourists that are forecast to visit Wellington each year as a result of the runway extension. As previously noted, although it is estimated that the runway extension would increase the value of goods and services purchased by international visitors by around \$100 million to \$500 million per year over the period of analysis, this only represents a relatively small proportion of the value of total retail sales, sales to tourists, and sales to international tourists by New Zealand businesses. As discussed further below, this means that the investment decisions of most New Zealand businesses are more likely to be driven by their expectations regarding the future demand for their goods and services by customers other than the additional international tourists that are forecast to arrive in Wellington each year as a result of the runway extension.
- How “capital intensive” it is to produce those additional goods and services (i.e. the amount of investment in physical and human capital that is required to produce additional units of those goods and services), which will depend on the types of additional goods and services supplied to international visitors and how those goods and services are produced. In general, the more capital intensive the production process, the greater the level of additional investment likely to be required in the longer term to supply additional goods and services.
- The efficiency with which New Zealand producers are producing the quantities of goods and services they are supplying in the short run (e.g. the extent to which businesses are fully using their existing physical and human capital, and are efficiently using their material inputs and labour). In general, the less efficient a business is in producing the goods and services it supplies in the short run, the lower and later the level of investment it requires to increase its supplies of goods and services in the longer run (i.e. by increasing its efficiency, a business can defer and reduce the amount of investment that it would otherwise have had to undertake in order to supply additional goods and services in the longer run).
- The timing of the expenditure by the additional international tourists visiting Wellington as a result of the runway extension can also have a significant impact on the extent to

which New Zealand businesses have to incur additional investment expenditure to supply the additional goods and services required by those tourists. For example, if that expenditure occurs during periods of the year where they still have excess capacity (i.e. when businesses are not fully utilising their capital), then the need for additional investment in the longer run will be reduced. By contrast, if it occurs during peak tourism periods, then greater levels of investment may be required.

- The extent to which the investment that is planned by New Zealand businesses to meet forecast increases in demand from all other customers (e.g. New Zealand consumers and tourists, as well as those international tourists who would have visited New Zealand even in the absence of an extended runway at WIA) is sufficient to accommodate some or all of the expected increase in their sales of goods and services to the additional international tourists that are forecast to visit Wellington as a result of the runway extension.

Further problems also arise as a result of the manner in which current financial accounting, national accounting and TSAs account for investment in human capital, which can also result in inaccurate estimates of the net benefits that New Zealand businesses would derive from the provision of additional goods and services to international tourists in the short and longer run.

Physical capital (e.g. equipment and buildings), is not the only type of asset in which businesses have to invest, even if they were to produce little or no output (i.e. they are not the only sources of unavoidable costs). Many businesses that supply goods and services to international visitors to New Zealand also have to incur significant amounts of expenditure on the purchase of other less-tangible assets that can be just as large and “lumpy” as expenditure on items of physical capital. This includes expenditure on the acquisition of assets such as the “human capital” (i.e. knowledge, skills and experience) embodied in their labour force (e.g. the human capital embodied in managers of hotels and resorts, chefs, fixed and rotating wing aircraft pilots, jet boat operators and fishing guides, to meet the needs of international visitors).

The traditional accounting practices that underlie both financial accounting reports for businesses, the SNA and subsets of the SNA (e.g. the TSA), do not classify human capital as an asset on the balance sheet. Rather, most labour costs are treated as an expense in the year in which they are incurred.

As noted by Dean, McKenna and Krishnan (2012), the issue is not whether or not businesses should be seeking to measure and report the value of human capital in the balance sheet of their financial statements; rather, the issue is how this could be achieved in practice:

“The challenge facing researchers is finding a way to consistently, accurately and objectively measure and report a value for human capital and find a place for this important factor of production on the balance sheet”.

Similarly, as noted by Wang, Zhang & Wang (2006), the System of National Accounts (SNA) also tends to focus on tangible assets (e.g. equipment, material inputs and consumer goods), and has largely ignored intangible assets such as the value of human capital:

“... the SNA, as the international standard of National Accounting, and the guide for unifying economic analysis (Zeng 1997) focuses on tangible assets accounting, such as equipment, material and consumer goods, with no concern for intangible assets (United

Nations 1968). Until revision in 1993, the SNA included some creative works as assets, for example, software, writings and musical compositions (SNA 1993). However, it still did not include technical inventions, human capital, and knowledge assets.”

Once again, while it is recognised that this current way of treating human capital creates problems, the pace of reform has been slow in view of the practical problems associated with implementing the appropriate treatment of human capital in the SNA:

“Some researchers (Kuznets 1946, Xu 1999, Zhuang & Guo 2003) have identified this problem in the classical national accounts and propose the introduction of human capital into the SNA. However, there has been slow progress in the adoption of these notions because of the particularity and complexity in defining human capital”.⁹²

As a result of this current approach to treating human capital, there is a risk that the use of financial reporting, national accounting or SNA data can result in inaccurate estimates of the net benefits that New Zealand businesses derive from supplying additional goods and services to international visitors. Specifically, it can result in the:

- Underestimation of the net benefits (i.e. additional producer surplus) that New Zealand businesses derive in each of the “short term” periods over the period of analysis (i.e. in each year) to the extent that it involves deducting “sunk” (i.e. unavoidable” human capital costs) that businesses would have had to incur even if they did not supply any additional goods and services to international tourists as a result of the runway extension, and
- Inaccurate estimates of the additional costs of investing in the additional human capital which New Zealand businesses would have to incur in the longer run in order to supply those additional goods and services to international tourists.

In summary, the preceding discussion highlights some of the significant challenges that the MBIE faces when trying to provide guidance as to the appropriate percentage that cost benefit analyses should apply to the gross value of the additional goods and services that are supplied to international tourists to estimate the net benefits that New Zealand businesses derive from supplying those additional goods and services. Inevitably the use of any proposed proportion will:

- Underestimate the net benefits derived by some businesses in some years and overestimate them in others, and
- Have an uncertain impact on the overall accuracy of the estimated net benefits for New Zealand businesses.

Desirable to adopt a consistent approach across projects to estimating the net benefits that New Zealand businesses derive from supplying goods and services to international visitors

To allow decision makers to evaluate the relative merits of alternative projects, a consistent methodology is desirable for estimating the net benefits the nation as a whole derives from

⁹² Wang, X., Zhang, Z., & S Wang (2006), Human Capital Accounting and the System of National Accounts Extension, *Research and Practice in Human Resource Management*, 14(1), 49-69.

the additional goods and services that New Zealand businesses supply to international visitors.

In particular, it is important a consistent methodology is used to estimate the “headline” estimates of the net benefits of each of the projects and project options, given that initial evaluations of the relative merits of alternative projects are often based on those “headline” results.

At the time of writing of this report, the most relevant guidelines for determining the net benefits that New Zealand derives from the expenditure of international visitors to New Zealand is that provided by MBIE in its:

- Post-Event Economic Evaluation Guidelines draft report.⁹³ Prior to the release of these guidelines, MBIE notes that it had not prescribed a specific economic evaluation approach for post-event reporting for individual events receiving MEDF investment, which had resulted in many different methodologies being used. The underlying rationale for adopting this new approach is to aid government investment decision making from the perspective of a complete assessment of economic benefits and costs at the national level, and
- Meta-Evaluation report, which uses these guidelines to retrospectively re-evaluate 18 previously reported post-event impact assessments.⁹⁴ The objective of this report was to apply a common measurement framework by way of a meta-evaluation that recast original economic impact estimates in a common and comparable framework. Given the draft status of the guidelines, however, MBIE noted that the final methodology might differ slightly to that used in the evaluation, but it did not expect that this would materially alter the conclusions and recommendations of that report.

These reports recommend that, based on 2012 NZ TSA data, the value that New Zealand businesses add to the goods and services they supply to international visitors should be assumed to be equal to 75 per cent of international visitor expenditure:

“Based on Statistics New Zealand’s March 2012 Tourism Satellite Account, value add to the New Zealand economy has been assumed to be a uniform 75 per cent of international visitor expenditure.”⁹⁵

MBIE acknowledged that this assumption may be at variance for certain events. However, it noted that:

⁹³ Ministry of Business Innovation and Employment (2013), *Post-Event Evaluation Guidelines*, Final draft for feedback. <http://www.majorevents.govt.nz/pdf-library/resource-bank/post-event-reporting/post-event-economic-evaluation-guidelines-320-kb-pdf>

⁹⁴ Ministry of Business Innovation and Employment (2013), *Economic Evaluation Outcomes: Major Events Development Fund, Meta-Evaluation Report*, prepared by Sector Performance Team, Institutions and Systems Performance Branch, Science, Skills and Innovation Group, May 2013. <http://www.majorevents.govt.nz/pdf-library/news/MEDF-evaluation-report.pdf>

⁹⁵ *ibid*, p52. The Post-Event Guidelines also note that using the Tourism Satellite account as a base, MBIE estimates 75% of international visitor spend accrues to New Zealand (see p13).

“... from the portfolio of many events perspective that is the basis of the current meta-evaluation, it is highly unlikely to materially bias international visitor expenditure value add up or down.”⁹⁶

As a result, consistent with this recommended approach, this report has assumed for the purposes of estimating the “headline” results of each of the options using the assumption that 75 per cent of the additional expenditure by the international tourists that visit Wellington as a result of the runway extension represent a net benefit to the community as a whole (i.e. it is assumed that 25 per cent of the value of that expenditure represents an economic cost to New Zealand).

Sensitivity analysis

Although it is important to adopt a consistent approach to estimating the “headline” net benefits the nation derives from New Zealand businesses supplying additional goods and services to international visitors, it is also important to recognise the considerable degree of uncertainty that surrounds the actual economic costs of supplying those additional goods and services.

As previously noted, the economic costs of supplying additional goods and services to the additional international visitors forecast to arrive in New Zealand are likely to differ significantly across businesses, industries and over time.

As a result, it is also important to test the extent to which the “headline” results of the cost benefit analysis are sensitive to changes in this underlying assumption regarding the net benefit arising from the supply of additional goods and services to international visitors.

It is for this reason that the sensitivity analysis conducted in Section 6 of this report evaluates the extent to which a range of change (i.e. up to 80 per cent and down to 10 per cent) from the assumed 75 per cent net benefit would alter the net benefits from each of the project options and the selection of the preferred option.

⁹⁶ Ibid, footnote 22, p70.

Appendix 4: Estimating the Value of Travel Time Savings

Overview

There are no existing estimates of the value of travel time (VoTT) savings for New Zealanders who travel by air.⁹⁷ Practical options to overcome this lack of data both involve translating figures derived in other contexts to the situation of New Zealanders travelling internationally by air. The ‘other contexts’ referred to are overseas values for air travel, or New Zealand values for land transport, both of which exist and provide a baseline from which to derive approximations suitable for our purpose.

The VoTT savings routinely used in the economic evaluation of land transport projects are produced by the New Zealand Transport Agency. A range of VoTT savings for air travel are available for Europe and the United States. In our view, the available options need not be mutually exclusive. That is, both sources of information provide insights which can be adapted and combined to provide useful VoTT savings estimates.

Basis for VoTT savings

The underlying premise for valuing travel time savings is that “time is money.” That is, there is an opportunity cost of the time spent travelling, which is important to include in analyses of projects that can affect the ease with which people are able to reach their desired destinations. Transport is in essence a derived demand – a consequence of demand for something else such as a vacation or business activities. All else equal, people would prefer to spend less time reaching their destination (and consequently more time at their destination).

Standard micro-economic theory postulates that individuals will adjust the amount of time they devote to work and leisure such that an additional small increment of either may be valued at the wage rate, and this seems to be contemporary practice.⁹⁸ However, more realistic and sophisticated models recognise that constraints on the ability of workers to alter work schedules or the conditions under which time is devoted to either work or leisure can cause the value people place on an incremental gain or loss of time to deviate, perhaps significantly, from the wage rate. Important factors identified include time of day choice, aversion to unreliability, labour supply, taxation, activity scheduling, intra-household time allocation, and out-of-office productivity.

Underpinning passengers’ valuation of travel time savings is their willingness to pay (WTP) to avoid delays. This WTP, which is implicitly related to income/ability to pay, can be

⁹⁷ The CASA guidelines used to determine VoTT savings indicate that there are no travel time savings estimates based on local Australasian studies. Hence, European values are adapted and converted to Australian dollar values using Purchasing Power Parity exchange rates.

⁹⁸ GRA and Aviation Specialists Group (2004) “*Economic Values for FAA Investment and Regulatory Decisions, A Guide.*” Report prepared for FAA Office of Aviation Policy and Plans.

empirically estimated through examination of passengers' stated and/or revealed preferences. Revealed preferences can be observed in the willingness of travellers to incur extra costs for such time savings as more convenient parking, expedited check-in and security screening or express air services, or their willingness to save money by selecting less quick air service or through their airport choices. Stated preferences can be seen through their responses to surveys about how their behaviour would change if confronted with proposed or hypothetical alternative scenarios.⁹⁹

This raises a salient point for any exercise involving the estimation of VoTT savings. After decades of study, the value of travel time remains incompletely understood. There is considerably more work needed to better align theoretical and empirical investigations.¹⁰⁰ A recurrent theme is that the value of time for a particular travel movement depends strongly on very specific factors, and that understanding how these factors work will provide new insights into travel behaviour and into more general economic choices.¹⁰¹ That is, there is much more still to know.

Practical approach

As mentioned above, no New Zealand-specific studies estimating values for passenger travel time savings for air travel exist. Undertaking a survey specifically for this project is not feasible. The main question then, is whether New Zealand values for surface transport provide more or less insight into likely values for air travellers leaving New Zealand than an adjusted international air travel equivalent.

We favour using air travel values as the basis for our VoTT savings estimates. We base this view on our belief that New Zealanders' air travel preferences are more closely related to air travel preferences overseas than they are on domestic surface transport preferences. That is, the difference between surface transport and air transport preferences is greater than the difference between overseas and domestic air travel preferences. Some support for this view is provided by assessment of the relevant VoTT estimates currently available.

Table 36 shows that VoTT estimates for air transport are typically considerably larger than those for surface transport. Air transport values that are two to three times those of surface transport would seem a reasonable approximation, based on the available evidence. The precise reason for such differences remains unclear. Differences in income of air travellers versus road and rail travellers have been identified as an explanation, though there is still some debate around the importance of income to the determination of VoTT. Other factors (besides income) thought to influence VoTT include distance, travel purpose, and social (as opposed to economic) considerations.

⁹⁹ U.S. Department of Transportation (2011) "*Revised Guidance on Valuation of Travel Time in Economic Analysis*" Memorandum from Assistant Secretary to Secretarial Officers and Modal Administrators, September 28.

¹⁰⁰ Small K (2012) "*Valuation of Travel Time*." Economics of Transportation, 1, pp2-14, December.

¹⁰¹ *Ibid.*

Table 36 Comparison of available modal VoTT estimates

Source	Air transport	Surface transport	Relativity
US Department of Transportation (2011)	US\$31.90 (Personal) US\$57.20 (Business)	US\$16.70 (Personal) US\$22.90 (Business)	1.9 2.5
Institute for Transport Studies, (2013) UK values ¹⁰²	£119.70 (Air user, Business)	£11.80 (Car user Inter-urban, Business)	10.1
Institute for Transport Studies, (2013) Europe non-UK values	£75.80 (Air user, Business)	£20.50 (Car user Inter-urban, Business)	3.7
Algers, Hugosson and Lindquist Dillen (1995), Sweden ¹⁰³	SEK182.35 (Business)*	SEK270.25 (Business)**	1.5
Mabit, Rich, Burge and Potoglou (2013), travel between Germany and Denmark ¹⁰⁴	€27.90	€8.50***	3.3
Hensher D (2011), synthesised values for the year 2000, long trips (over 300km) ¹⁰⁵	US\$52.31 (Business) US\$30.85 (Non-business)	US\$22.12 (Business)**** US\$9.75 (Non-business)****	2.4 3.2

*= simple average across income groups; ** simple average across income groups for car and inter-city rail users; ***=simple average of car, bus and rail modes; ****= car values.

In addition, the available data shows the estimated relativity between the VoTT for business and leisure travel (equivalently work and non-work). That is, the data allow us to consider the issue of how business and leisure VoTT differs both across and within modes. Again, we favour within-mode comparison. Table 37 compares VoTT estimates across time categories and travel purpose.

Two key points stand out. First, the relativity New Zealand estimates for different land transport travel purposes differs markedly from observed relativities elsewhere. Even within-surface transport comparisons show that the difference between leisure and work

¹⁰² Institute for Transport Studies, (2013) *“Valuation of Travel Time Savings for Business Travellers.”* Main report, prepared for the Department for Transport, April.

¹⁰³ Algers, Hugosson and Lindquist Dillen (1995), *“The National Swedish Value of Time Study.”* Proceedings of Seminar F, PTRC Summer Annual Meeting, cited in Institute for Transport Studies, (2013).

¹⁰⁴ Mabit S, J Rich, P Burge and D Potoglou (2013) *“Valuation of Travel Time for International Long-Distance Travel-Results from the Fehmarn Belt Stated Choice Experiment.”* Journal of Transport Geography 33, pp. 153-161.

¹⁰⁵ Hensher, D.A. (2011) *“Value of Travel Time Savings”*, Handbook in Transport Economics (Chapter 7), edited by André de Palma, Robin Lindsey, Emile Quinet, Roger Vickerman (Edward Elgar Publisher, UK), 135-158.

travel time values in New Zealand is considerably (i.e. 2.5 times) larger than comparative values elsewhere. Secondly, the difference in air travel time values between business and leisure is generally modest. An intuitive explanation for this is that the opportunities brought about by leisure travel by air are significantly more valuable than those in say, a car.

Table 37 Travel purpose comparisons

Time category	Business	Leisure	Relativity
<i>Airport Cooperative Research Program (2015)¹⁰⁶</i>			
Flight time	\$51.00	\$34.90	1.46
Ground egress and access	\$18.60	\$16.95	1.10
Terminal access time	\$33.85	\$26.00	1.30
Check-in and security time	\$37.20	\$28.45	1.31
Ground egress and access	\$18.60	\$16.95	1.41
<i>US Department of Transportation (2011)</i>			
Air value of travel time (inter-city)	\$57.20	\$31.90	1.79
Surface value (excluding high speed rail) of travel time (inter-city)	\$22.90	\$16.70	1.37
<i>Civil Aviation Safety Authority Australia (2010)¹⁰⁷</i>			
General aviation travel time values	\$64.29	\$45.09	1.43
<i>Hensher (2011)</i>			
Synthesised air values for the year 2000, long trips (over 300km)	\$52.31	\$30.85	1.70
<i>New Zealand Transport Agency (2014 Values)¹⁰⁸</i>			
Land transport values of travel time- upper bound	\$33.87	\$9.80	3.46

¹⁰⁶ Airport Cooperative Research Program (2015) "Passenger Value-of-Time, Benefit-Cost Analysis, and Airport Capital Investment Decisions; Volume 1: Guidebook for Valuing User Time Savings in Airport Capital Investment Decisions." Contractor's Guidebook for ACRP 03-19, submitted to Transportation Research Board.

¹⁰⁷ Civil Aviation Safety Authority (2010) "Standard Economic Values Guidelines" Australian Government, November, table 2.4.

¹⁰⁸ NZIER (2016) "Stretching runway numbers- Review of cost benefit analysis of proposed Wellington Airport runway extension." Report to BARNZ, February, p.21.

What the evidence implies- a worked example

While our view is that surface transport and air transport values of travel time are “apples and oranges” a worked example using the New Zealand land transport VoTT estimates provides very useful “apples with apples” insights.

The first step involves applying the relativity between respective travel purposes in the Civil Aviation Safety Authority Australia (CASA) estimates, which we used for our VoTT figures, to the New Zealand Transport Agency (NZTA) upper-bound figures.¹⁰⁹ We then apply an average relativity multiplier of 2.5, based on the relationship between air travel and surface travel VoTT summarised in Table 36.

This process results in air-travel equivalent VoTT estimates for New Zealand travellers of \$34.93 (business) and \$24.50 (leisure) if NZTA leisure values are assumed as the “correct” base. The equivalent figures using the NZTA business values as the “correct” base are VoTT estimates of \$84.68 (business) and \$59.39 (leisure).

Table 38 Implied VoTT for New Zealand air travel using NZTA values

	Business	Leisure
Starting values	\$33.87	\$9.80
Apply travel purpose relativity using leisure values as base (business value equals leisure value times 1.43)	\$13.97	\$9.80
Apply travel purpose relativity using business values as base (leisure value equals business value divided by 1.43)	\$33.87	\$23.75
Apply transport mode relativity using leisure values as base	\$34.93	\$24.50
Apply transport mode relativity using business values as base	\$84.68	\$59.39
<i>Values used in this analysis</i>	<i>\$76.20</i>	<i>\$53.60</i>

The leisure values used by NZTA are derived using an ‘equity’ approach (that departs from willingness-to-pay techniques used for business travel purposes). In essence this approach looks to use an average figure to adjust for income differences, notwithstanding that behavioural values of time differ by numerous factors not related to income.¹¹⁰ The use of such an approach for non-work travel is not without contention.¹¹¹ Given this debate, and

¹⁰⁹ We could have applied surface transport relativities (i.e. used 1.37 as opposed to 1.43 as the relativity between business and leisure travel purpose), however, our intention is to subject the VoTT estimates we used to scrutiny and using the CASA relativity is consistent with that objective. Using the lower relativity number would increase the end values.

¹¹⁰ Wallis I, K Rupp and R Alban (2015) “Travel time saving assessment.” New Zealand Transport Agency research report 570.

¹¹¹ Ibid, p.45.

the intuition around the value of leisure time associated with air travel, we favour the use of the NZTA business value as the “correct” base.

The results of this translation exercise, which does not rely on income differentials or exchange rate conversions, indicates that the VoTT estimates we used for air travel by New Zealanders are reasonable and may even be underestimated.

Some submitters have suggested that the starting values need to be adjusted for differences in income across countries. Given the influence of a range of factors other than income in determining the VoTT and the lack of available data on the incomes of the travelling passengers modelled in this analysis, we have not sought to apply any specific income-related adjustment to the VoTT estimates.

We note, however, that the NZIER submission for BARNZ applied what appears to be a blanket adjustment for relative income levels between Australia and New Zealand that results in VoTT estimates that are 24 per cent lower than those we used.¹¹² This adjustment looks to adjust the VoTT for changes in income. Implicitly it assumes unit elasticity (i.e. the percentage change in the VoTT is equal to the percentage change in income). No empirical estimate of the income elasticity of VoTT for New Zealand air travellers exists, but Wallis et al (2015) confirm that for surface transport that elasticity is 0.4 (i.e. a 10 per cent change in income is associated with a 4 per cent VoTT change).

Notwithstanding the concerns around the degree to which a land transport parameter should be applied to air travel, this elasticity implies that an effective drop in income of 24 per cent would result in a reduction of around 10 per cent in VoTT. Applied to the “translated” VoTT estimates in Table 38 above results in values that are almost identical to those we used in the analysis.

In summary, there is strong support in the available evidence for the values we have used for travel time savings for New Zealand air passengers in this analysis.

¹¹² NZIER (2016) *Op. cit.* p.21.