NELSON AIRPORT

RUNWAY EXTENSION

OPTIONS ASSESSMENT REPORT

FINAL

19 December 2022

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1. Introduction

i. Background

Nelson Airport Ltd (NAL) has engaged Airbiz Aviation Strategies Ltd (Airbiz) to prepare an assessment of options and outline the reasonable necessity for the provision of a longer runway to service the community of the Nelson-Tasman region and meet future demands of fleet mix to service that demand.

NAL has signalled the need for a longer runway for many years through its annual reports, master plan and other public documents to resolve constraints and impediments associated with the current runway configuration. NAL is now progressing plans to extend its existing runway and requires amendments to its existing designations and to the associated district planning controls.

Nelson Airport's runway is among the shortest in the world catering for the types of aircraft it services. The current runway length leads to payload restrictions for Air New Zealand ATR72 and Originair Jetstream aircraft. Under certain weather conditions, passenger and freight capacity is limited, impacting reliability for travellers, businesses and their customers. Air New Zealand and Originair have confirmed a longer runway would remove those restrictions.

Significant effort is being expended globally in the development of sustainably powered aircraft – expected to be powered by batteries, hydrogen, and or sustainable aviation fuels. There are still many challenges to overcome including aircraft performance and incorporating new technology into larger aircraft. The current focus in aircraft development is on fuel efficiency and sustainable alternatives to fossil fuels rather than optimising aircraft performance for short runways, such as at Nelson Airport. An extended runway is the best way for Nelson Airport to prepare for next generation aircraft.

The amendments sought to NAL's existing designations would enable operations on a longer runway and manage noise exposure and obstacles (such as masts, tall chimneys and trees) that could limit the Airport's ability to operate in future.

ii. This Report

NAL has engaged Airbiz Aviation Strategies Ltd (Airbiz) to prepare this assessment of needs and options for extending the existing main runway at Nelson Airport, and to assess and compare the options from an aeronautical viewpoint.

This Options Assessment report:

- Provides a description of the current situation, operations and business needs for the Airport,
- Outlines the future operational and business needs that require a longer runway,
- Sets out the relevant technical requirements needed to service the various aircraft types and routes for future operations,
- Outlines the options for extending the existing runway,
- Provides a preliminary evaluation of the merits of each option, and
- Includes a recommendation as to which option is preferred.

iii. Consideration of options for an extended runway

Where a longer runway system is required for functional and safety purposes as outlined earlier in this report, at a high level an airport company could conceivably consider:

- Extending its existing runway,
- Constructing a new longer runway on its existing airport site, or
- Constructing a new longer runway on a new site (i.e. move the airport).

At Nelson, it would be both costly and inefficient (effectively unfeasible) to acquire valuable land and build a new airport that replicates the high-quality infrastructure (including existing runway system, recently redeveloped terminal facilities, supporting development and network of infrastructure) already in place for a project of this kind. The new terminal itself opened in October 2019 and will cater for growth projections beyond 2035.

Equally, constructing a completely new runway on the existing site, replicating the runway network already in place, would effectively require a complete reconfiguration of the entire airfield infrastructure to continue to provide efficient access to and from the passenger terminal as well as a grass runway for separated general aviation operations, which is another important efficiency aspect of the current existing infrastructure. Further, due to the shape of the airport site there is no other position where there would be sufficient land (length) to build a new equivalent runway, let alone a longer runway (Refer to Figure 2-1). Any alternative location for a new runway on the existing site would necessitate a major reclamation of land from the Waimea Estuary.

Accordingly, options such as relocating the airport or building a completely new runway on the current airport site have been discarded, being considered unrealistic alternatives in terms of meeting the Airport's objectives in terms of providing a longer runway for functional and safety purposes.

In the present case, and as supported in the Master Plan, NAL has focused on two options for extending the existing runway. These are described and assessed in detail in Section 6.

2. Existing Situation

i. Airport Role and Description

Nelson Airport is a key strategic gateway that enables air travel, connectivity and freight transport for around 104,000 residents in the Nelson-Tasman region. The Airport is also the gateway for visitors flying into the region from other parts of New Zealand and from overseas to visit friends and relatives, and for business, education, leisure and tourism. The Airport is operated by NAL on behalf of shareholders Tasman District Council and Nelson City Council (NCC), which hold equal shares on behalf of their communities.

The Airport occupies a coastal site of 129 hectares located approximately 7 km from the city centre and provides a main sealed runway of 1,347m length and two grass runways. The main runway length is shorter than what is generally recommended and usually provided for the types of aircraft currently using it and is among the shortest runways in the world catering for Code C aircraft (with a wingspan of 24 to 36m). This results in some operational restrictions for airlines.

In 2019, prior to the Covid-19 pandemic, 1,077,000 passengers used the Airport (departing or arriving), placing Nelson Airport as the equal 5th busiest domestic airport in New Zealand (with Dunedin).

The existing configuration of the airport is shown in Figure 2-1 following.

Figure 2-1: Nelson Airport Existing Configuration

ii. Current Business and Operational Needs

Compared to many other New Zealand airports, Nelson Airport is well served by airlines. Frequent Air New Zealand services connect Nelson to Auckland, Wellington, and Christchurch, and onwards to many international destinations for outbound and inbound passengers. Air New Zealand operations are provided primarily with ATR 72-600 and Bombardier Q300 turboprop aircraft with 68 and 50 seats respectively.

Local connections are also provided to:

- Wellington and the Kāpiti Coast, by Sounds Air, with Cessna Caravan (12 seats) and Pilatus PC12 (9 seats) aircraft,

- Wellington, Hawke's Bay, Palmerston North, and Hamilton, by Originair with Jetstream J32 (18 seats) aircraft, and
- Freight is carried as supplementary payload, as space and weight capacity permits, on passenger services.

The current runway length leads to payload restrictions for Air New Zealand ATR72 and Originair Jetstream aircraft. Under certain weather conditions, passenger and freight capacity are limited, impacting reliability for travellers, businesses and their customers. Air New Zealand and Originair have confirmed a longer runway would remove those restrictions for current aircraft.

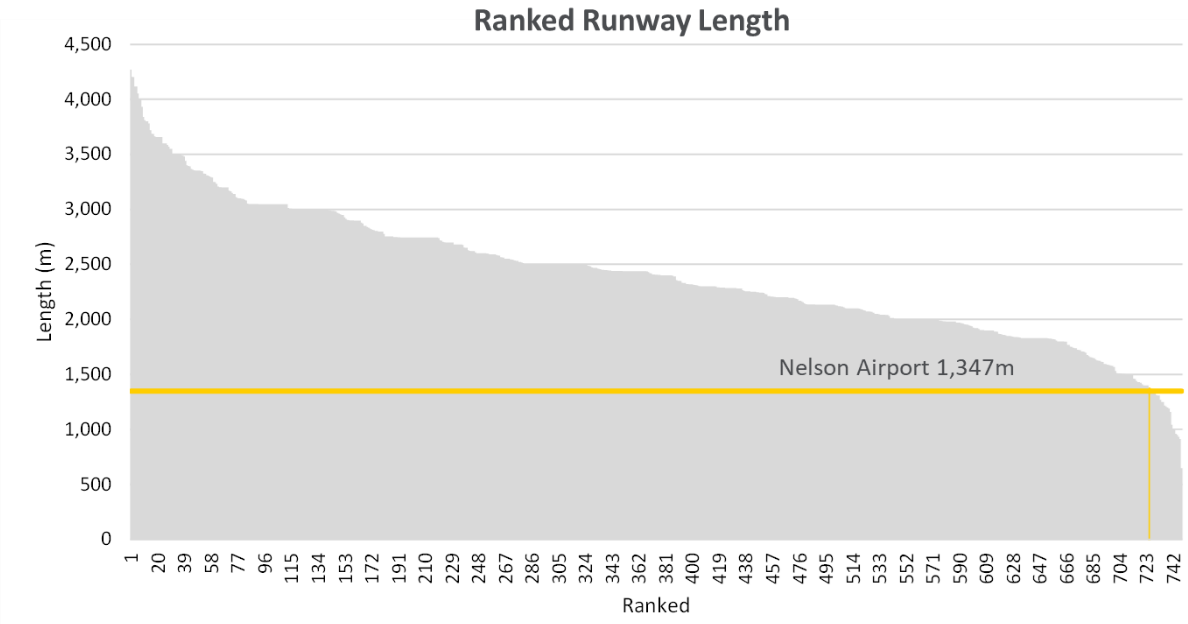
The current runway also does not provide Runway End Safety Areas (RESA)[1] which would enhance the safety of operations by providing space for undershoot or overshoot incidents.

General Aviation (GA) activities include both fixed and rotary wing operations, commercial and recreational, utilising the main runway and a parallel grass runway.

[1] A RESA is a graded area provided at the ends of a runway to reduce the risk of damage to aircraft in the event of an undershoot, overshoot, or excursion from the runway.

iii. Nelson Airport's Runway

Airbiz has undertaken a benchmarking analysis of approximately 750 airport runways in the world that cater for Code C aircraft (i.e. single aisle jets and turboprops). Figure 2-2 below depicts the ranked order of runway lengths for the benchmark set and shows that Nelson Airport's runway at 1,347m is among the very shortest in the world catering for the types of aircraft it services.



Excludes Airports with <200,000 annual seats (2019)

Figure 2-2: Nelson Airport Runway Length – compared with World Code C Airports

Airbiz then examined a reduced set of world airports that catered only for Code C turboprop aircraft (i.e. no jet operations) as depicted in the following graphic. This graphic shows ranked runway length (left side axis) but also includes annual passenger movements at each airport (right side axis).

Figure 2-3: Nelson Airport Runway Length and Annual Traffic – compared with World Code C Turboprop-only Airports

The majority of these world airports cater for 200,000 to 500,000 annual passengers with runways of 1500m to 2000m length, while Nelson Airport, at approximately 1.1 million annual passengers, is second in the world for traffic levels to Toronto City (Billy Bishop) Airport with approximately 2.6 million passengers.

It should be noted that Toronto City has been proceeding for several years with planning processes to allow jet operations to occur.

3. Future Business and Operational Needs

i. Scheduled Airline Operations

NAL has undertaken consultation discussions with the airlines currently servicing Nelson. Those discussions have determined that there are currently payload restrictions resulting from the short runway for:

- Air New Zealand operations of ATR72-600 and Originair Jetstream J32 aircraft in some unfavourable weather conditions, and
- Originair Jetstream J31 aircraft in all conditions.

Sounds Air advised that their operations are not restricted by the current runway length.

Airbiz and NAL have discussed intentions for future aircraft types with Air New Zealand who indicated that:

- Jet operations are a possible consideration for Nelson, due to its relatively high traffic levels for a New Zealand regional airport, and
- If and when the airline were to operate a jet service, the only realistic jet route envisaged for an extended period of time would be Nelson-Auckland. This would involve basing a jet overnight at Nelson Airport for a morning departure, and in that case a morning jet service would most likely depart prior to 7am.

NAL has considered this advice and assessed that:

- The need for a jet service to Auckland is not a certain or absolute requirement within the short to medium term planning period (3-10 years) because higher demand levels, including at peak periods, could still be catered for with increased frequencies by turboprop aircraft, and Air New Zealand might still, ultimately choose to continue with only turboprops servicing the route,

- Jet services, if established, would, for the short to medium planning term (3-10 years) be on only one route (Auckland) and likely only at morning and evening peak periods,
- Jet operations would generate increased adverse effects for residents near the Airport (aircraft noise and restrictions on land use activities).

ii. New Generation Sustainable "Green" Aircraft

NAL is very aware that significant effort is being expended globally in the development of sustainably powered aircraft, expected to be powered by batteries, hydrogen, and or sustainable aviation fuels. There are still many challenges to overcome, including aircraft performance and incorporating new technology into larger aircraft.

NAL has sought advice from experts in the field of future sustainably powered passenger aircraft who have reported as follows in summaries extracted from their respective reports to NAL:

Eric Morgan (ELM Associates)[2]

"The current focus in aircraft development is on fuel efficiency and sustainable alternatives to fossil fuels rather than optimising aircraft performance for short runways, such as at Nelson Airport.

New energy sources, aircraft, and powertrain developments are necessary to achieve sustainable aviation goals, especially for short range turboprop equivalent aircraft. Essential new aircraft types capable of serving Nelson's high demand market are likely to be larger and heavier than current types for a given configuration. It is anticipated that these new aircraft will enter the New Zealand market in the near to medium term (2030-35).

Nelson Airport's runway, which has limited capability, may not be long enough to sustain the volume of operations necessary to support future demand from these new aircraft types. An extended runway is the best way for Nelson Airport to prepare for next-generation aircraft."

[2] "Future Sustainable Aircraft: An Outline of Potential Issues for Nelson Airport", ELM Associates Ltd, 9 September 2022

Dr M Orchard [3]

"As the awareness of the impacts of pollution on the environment become better known, the aviation industry is facing significant pressure to decarbonise and eliminate polluting emissions. The challenge should not be underestimated as due to the fundamentals of aviation the technology hurdle to decarbonise aviation is of the order of 20 times more difficult than the equivalent effort required to decarbonise the automobile.

Of the technologies being proposed for the transition to zero emissions flight, those gaining the most focus are battery-electric, and gaseous and liquid hydrogen fuel used with fuel cells and gas turbines. Application of these technologies is proposed both via conversions of existing aircraft as well as purpose designed aircraft fully adapted to these new propulsion systems. The introduction of such zero emissions aircraft technology has been proposed for as early as 2026, but it is more likely in the 2028-2030 timeframe, with large scale introduction occurring in the mid-2030's.

Analysis of future purpose-designed zero emissions aircraft indicates that all of the technologies choices will likely result in an increase in the maximum take-off weight compared to a traditional aircraft like the ATR72 for the same passenger capacity. For battery-electric and gaseous hydrogen the technology limitations are such that not only will the overall aircraft weight increase significantly, but the passenger capacity, cruise speed and range may be inferior to existing aircraft. Only aircraft based on liquid hydrogen technologies are likely to allow a direct replacement of current aircraft. Analysis shows purpose designed zero emissions aircraft types to replace the ATR72 will likely require between 1373m and 1530m of runway length, making all of them incompatible with Nelson Airport's current 1347m runway.

Conversions of existing aircraft with zero emissions propulsion systems are likely to occur as an interim solution until the introduction of all new purpose designed types is possible. These converted aircraft may have the same maximum weight as the pre-conversion aircraft, but will have a reduction in both passenger capacity and a lower payload fraction than the original baseline aircraft. This will make them much more weather sensitive to short runways like Nelson Airport's runway. Analysis shows that a small weather variation that might only require a 1% reduction in payload for an ATR72 with Nelson Airport's short runway could

[3] "Impact of Future Zero Emissions Aircraft on Nelson Airport Runway Needs", Dr M Orchard, 19 August 2022

require between 10-18% payload reduction on a converted zero emissions aircraft type. Such sensitivity to short runways will likely require periodic passenger off-loading, making the availability of service for these converted types from Nelson Airport's runway unreliable to the point of being uneconomic.

Purpose designed zero emissions aircraft, whilst requiring a longer runway length than converted types will have less sensitivity to payload fraction, albeit analysis indicates they could still require a 6-8% payload reduction in weather conditions where an ATR72 only requires a 1% reduction.

An extension of Nelson Airport's runway to 1510m would not only allow both converted and purpose designed zero emissions aircraft to use Nelson Airport, it would provide sufficient runway length to give margins for common occurrence weather events to ensure service reliability and economic operations."

iii. NAL Approach for Establishing Target Runway Length

NAL and its Board have closely assessed the advice received from airline consultation and its experts in the field of sustainably powered aircraft and concluded that its approach in respect of a runway extension will be built around a key focus of providing for future sustainable aircraft that are likely to be heavier than current types and require more runway length. To this end NAL has determined that the main runway should be extended to cater for such emerging aviation technology and to:

- Reduce or remove current limitations on passenger and freight capacity under certain weather conditions, thereby improving reliability for travellers, businesses and their customers, and
- Provide for RESAs in conjunction with a runway extension to improve the operational safety aircraft operations.

NAL has determined that to amend the Airport's existing designations and associated district planning controls to allow for jet operations in the longer term future would be unreasonable given that:

- Efficiencies associated with jet operations is uncertain and likely impractical based on short to medium term passenger forecasts,

- The investment business case for extending the runway to approximately 1800m to cater for jet operations only at peak periods for possibly only one route would be difficult to sustain (compared to meeting the same demand through smaller non-jet Code C aircraft), and
- Jet operations would generate increased adverse effects for residents near the Airport (aircraft noise and restrictions on land use activities).

Accordingly, NAL has decided that jet operations would be excluded from consideration within the timeframe of the current planning framework. Rather, NAL seeks to provide for the target runway which would remove operational constraints experienced by existing aircraft and to support the operational needs of future aircraft types.

iv. Runway Extension Availability

In the course of recently updating the Airport Master Plan, Airbiz undertook an assessment of the extension availability for the current runway, assuming an extension was provided primarily to the north for the purposes of the Master Plan, and provisions made for RESAs (see Appendix A to this report)[4].

The methodology for the Master Plan analysis was to determine how long the main Runway 02/20 could be extended the to the north (Runway 20 end) by identifying the critical constraint from either:

1. The ability to accommodate a configuration with a RESA to the north of the extended runway, starting at the north end of the runway strip, extending a further distance of 240m, or
2. The ability to accommodate the northern Approach Surface, starting at the north end of the runway strip, rising to the north at a slope gradient of 1:50, while
3. Providing for a RESA at the southern end of the runway.

It was found that the obstacle constraints potentially conflicting with the Approach Surface-at the north was the more critical criterion resulting in a shorter runway extension availability at the north end than

[4] "Nelson Airport Master Plan, Runway Length Availability Analysis", Airbiz, 4 October 2021

the northern RESA distance constraint. Considering the positions, heights and physical nature of obstacles to the north of the runway, it was assessed that the available runway extension to the north would be an additional 370m.

However, the provision of a RESA at the southern end of the runway (02 end) on Airport land requires that the southern end of the runway would need to be displaced northwards (shortening the runway) by a distance of 207m. The net effect of the southern shortening and northern end lengthening would produce a runway 163m longer than current, achieving an extended length of 1,510m, as shown in Figure 3-1 below.

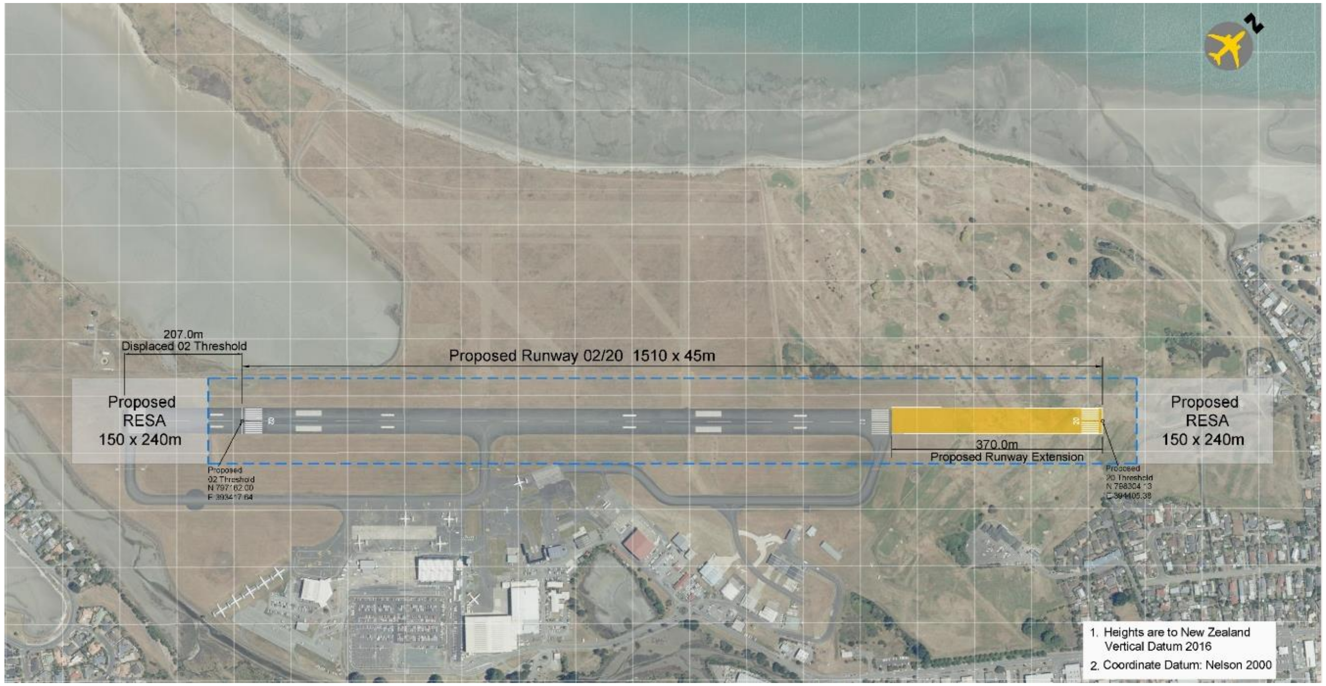


Figure 3-1: Runway Extension Availability with RESAs

v. Nelson Airport Master Plan

Nelson Airport regularly reviews and updates its Airport Master Plan and in early 2022 completed a further update (2050 Airport Master Plan). The Master Plan is an important guide for Airport land use and a plan that allows NAL to provide for future activity in a flexible, efficient and safe manner that continues to support the community aspirations of the Nelson Tasman region.

The Nelson Airport Master Plan 2050:

- Is the framework for protecting existing and future core aeronautical activities,
- Informs Nelson City Council's land use planning, and
- Provides the Airport's neighbours and the wider community with information on Nelson Airport's plans for the future.

The 2050 Master Plan confirms the need for a longer runway extended to 1,510m.

4. Nelson Airport Traffic Forecasts

i. Drivers of Demand

Nelson Airport's activity and success is driven by the success of the region it serves. Airport activity is a direct result of the region's liveability for locals, its economic opportunities and connections, the desire of locals to travel nationally and internationally, and its attractiveness to visitors, from both New Zealand and overseas.

The number of passengers who pass through Nelson Airport each year is large relative to the population of the Nelson Tasman region, when compared with other domestic-only airports in New Zealand. This level of activity can be attributed to:

- The dynamic nature of locals who love to travel and to create successful businesses,
- The attractiveness of the region to domestic and international visitors, and
- The relative geographic remoteness of the region which makes air travel a quicker and more efficient option than other modes of travel.

In 2019, NAL commissioned Tourism Futures International (TFI), a highly experienced and respected consultancy based in Sydney, to prepare air traffic forecasts for Nelson Airport. TFI's original forecasts were prepared in June 2019 drawing on traffic (historical) and economic data (historical and forecast) that was available in early 2019.

In September 2019 Jetstar announced that it was to withdraw from regional flying in New Zealand (its Q300 turboprop services) at the end of November 2019. In response to this NAL requested TFI to review the implications of this supply-side change. TFI reviewed the situation and provided revised forecasts in their report "Nelson Airport Traffic Forecasts", dated December 2019. The TFI report is attached as Appendix B to this report.

In their report TFI explained that longer-term drivers of air traffic at Nelson Airport would include growth in New Zealand GDP per capita, assumed changes in New Zealand domestic airfares, changes in the Tasman and Nelson regional populations, and forecast growth in international visitors to New Zealand. In the shorter term for the period to 2022, TFI noted a significant factor would be estimates of capacity changes following Jetstar's withdrawal from operations to regional New Zealand airports.

ii. TFI Forecasts to 2040

TFI prepared forecasts (in 2019) for the period FY2020 to FY2040, comprising projections of annual passenger and aircraft movements.

For passengers, projections were provided for three scenarios: Base Case (also referred to as Central), High and Low. A key factor at that time was the short-term impact of the Jetstar withdrawal of service resulting in TFI making a relatively conservative passenger projection for 2025 (1.071 million passengers) which was less than actual traffic levels for 2019 (1.077 million).

For aircraft movements, projections were provided for two scenarios: Central and High, corresponding to the Passenger Base Case and High scenarios. For aircraft movements, each scenario projection (Central and High) was disaggregated into:

- Scheduled passenger aircraft movement numbers assuming no jets introduced in the future,
- Scheduled passenger aircraft movement numbers assuming jets might be introduced in the future, and
- General Aviation aircraft movement numbers.

Being prepared in 2019, TFI's forecasts predated the arrival and effects of the COVID-19 pandemic which, from March 2020 dramatically altered the aviation landscape as borders to New Zealand were closed, and most aviation activity, including domestic operations serviced by Nelson Airport were severely curtailed. The longer term effects and recovery from the pandemic and implications for Nelson Airport's traffic forecasts are discussed later in this chapter.

The TFI forecasts were also prepared some 2 years prior to NAL's decision to not provide capability for scheduled jet services (and instead meet that demand through increased turboprop aircraft frequency), and accordingly an aircraft movement scenario with jets was provided by TFI at that time. Subsequent work on forecasts, described following, has taken due account of the NAL decision to exclude jets from consideration.

The TFI traffic forecasts (2019) are summarised in Figure 4-1 and *Figure 4-2* following (tables and graphic extracted from the TFI report).

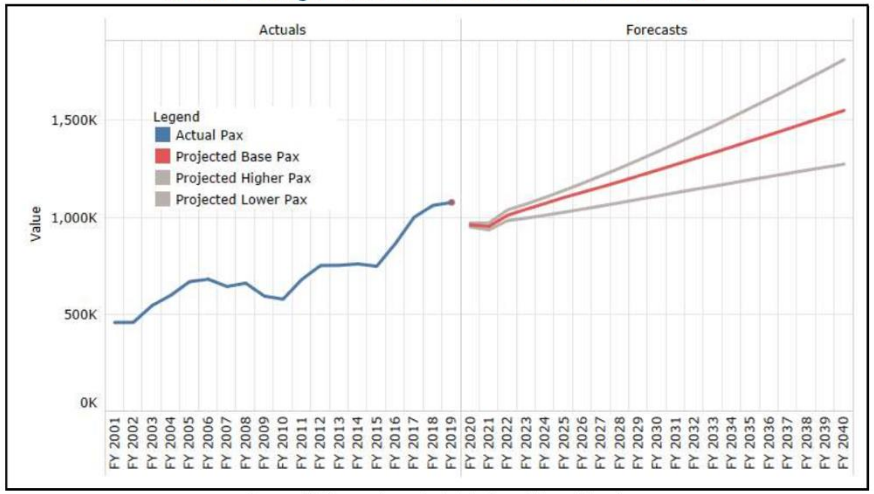
Table 1.1: Passenger Forecast Variants for Nelson Airport – Actual Passengers to FY19 and Forecasts for FY20 to FY40

Years end 30 June	Actual Pax	Base Case	High Scenario	Low Scenario
2014	759			
2019	1,077	1,077	1,077	1,077
2020		961	971	950
2021		953	971	935
2022		1,011	1,038	983
2023		1,042	1,068	996
2024		1,071	1,103	1,010
2025		1,102	1,138	1,025
2030		1,243	1,337	1,109
2040		1,551	1,813	1,274
CAGR				
2014 to 2019	7.2%			
2019 to 2025		0.4%	0.9%	-0.8%
2025 to 2040		2.3%	3.2%	1.5%

Source: TFI forecasts, actual data from Nelson Airport

Passenger numbers expressed in thousands of passengers per year

Figure 1.1: Passenger Forecast Variants for Nelson – Actual Passengers to FY19 and Forecasts for FY20 to FY40



Source: TFI forecasts, actual data from Nelson Airport.

Figure 4-1: TFI Passenger Movement Forecast to 2040 (prepared pre-COVID)

Table 7.1: Aircraft Movement Forecast Variants for Nelson Airport – Central Forecasts

	Central Forecast				
	Scheduled Passenger Movements - No Jet Aircraft (a)	Scheduled Passenger Movements - With Jet Aircraft (b)	Other General Aviation	Total Movements (a)	Total Movements (b)
	'000s Movements				
FY19 Estimate	25.4	25.4	11.9	37.3	37.3
FY25	24.8	24.8	12.3	37.0	37.0
FY30	27.2	26.5	[illegible]	[illegible]	[illegible]
FY40	32.6	30.4	[illegible]	[illegible]	[illegible]
	CAGR				
2019 to 2025	-0.4%	-0.4%	0.5%	-0.1%	-0.1%
2025 to 2040	1.2%	0.9%	0.2%	0.9%	0.7%

Source: TFI forecasts, FY19 estimated data from Nelson Airport

The label reference in the TFI table above should say "High Forecast" instead of "Central Forecast"

Table 7.2: Aircraft Movement Forecast Variants for Nelson Airport – High Forecasts

	Central Forecast				
	Scheduled Passenger Movements - No Jet Aircraft (a)	Scheduled Passenger Movements - With Jet Aircraft (b)	Other General Aviation	Total Movements (a)	Total Movements (b)
	'000s Movements				
FY19 Estimate	25.4	25.4	11.9	37.3	37.3
FY25	25.6	25.6	12.3	37.8	37.8
[illegible]	[illegible]	28.6	12.5	41.8	41.1
[illegible]	[illegible]	35.5	12.8	51.0	48.3
	CAGR				
2019 to 2025	0.1%	0.1%	0.5%	0.2%	0.2%
2025 to 2040	1.8%	1.5%	0.2%	1.3%	1.1%

Source: TFI forecasts, FY19 estimated data from Nelson Airport

Figure 4-2: TFI Aircraft Movement Forecast to 2040 (prepared pre-COVID)

iii. Extension of Forecasts to 2050

To provide data for a proposed 30 year planning horizon NAL engaged Airbiz to prepare a 2050 annual passenger traffic forecast for NAL by adopting the TFI Central forecast to 2040 without change and extrapolating this for 10 additional years from 2040 to 2050. This was achieved by applying passenger movement growth rates for the extended period from 2040 to 2050 which relate to the passenger growth rates in the later stages of the TFI forecast. The passenger movement forecasting outcomes by both TFI and Airbiz were independent and not affected by the later decision from NAL to exclude jets from consideration (which had an effect only on the assessment of aircraft movement forecasts).

Extended aircraft movement forecasts for 2050 have also been generated by assessing and applying an aircraft mix for 2050, generally equivalent to 2040. The mix for scheduled aircraft comprises estimates of the proportions (weightings) of various aircraft types and seating capacities, excluding jets in the mix following NAL's direction, which together generate an estimated average aircraft seat capacity for each future year. This projected mix has been derived by considering the historical mix of aircraft types, changes and trends noted in recent years, and consideration of how this might change in future years on various routes flown by various operators.

Together with a projected load factor[5], the average seat capacity has been applied to the passenger projections to derive projected aircraft movement numbers, for each aircraft type and in aggregate.

Corresponding to the TFI projection set, each aircraft movement scenario projection to 2050 (Central) for scheduled aircraft was disaggregated by Airbiz into:

- Scheduled aircraft movement numbers assuming no jets introduced in the future, and
- General Aviation aircraft movement numbers for the extended timeframe were extrapolated from the TFI growth rates.

The extended 2050 passenger and aircraft movement forecasts are summarised in Figure 4-3 and Figure 4-4 respectively following.

[5] Load factor is the average percentage of available seats on groupings of scheduled passenger aircraft operations (capacity) that are occupied by passengers.

		Actual Historical Annual Passengers[6] ('000)	Annual Passenger Projections ('000)
Year	Source	Actual	Central Scenario
2019	TFI	1,077	
2025	TFI		1,071
2030	TFI		1,243
2035	TFI		1,394
2040	TFI		1,551
2045	Airbiz		1,715
2050	Airbiz		1,884
CAGR[7]			
2019 to 2025	TFI		0.4%
2025 to 2040	TFI		2.3%
2035 to 2040	TFI		2.2%
2040 to 2050	Airbiz		2.0%

Figure 4-3: Nelson Airport Extrapolated Passenger Forecast to 2050

Aircraft Types	Central Scenario Without Jets	
	Number p.a.	*% of mix*
Passenger Aircraft		
A320	0	0%
Small Jet	0	0%
ATR72	33,442	65%
Q300	0	0%
Saab 340	942	2%
Other Scheduled	4,088	8%
Non-scheduled Turbo Prop	564	1%
Non-scheduled Jet	120	0%
Sub-total Passenger Aircraft	39,156	76%
General Aviation Aircraft		
GA - Piston Single Engine	6,540	13%
GA - Piston Twin Engine	1,289	3%
GA - Turboprop	1,532	3%
Helicopter - Piston	628	1%
Helicopter - Turbine	2,269	4%
Sub-total GA Aircraft	12,258	24%
Total All Aircraft	51,414	100%

Figure 4-4: Nelson Airport Extrapolated Aircraft Movement Forecast to 2050

[6] In this context the terms "passengers" or "passenger numbers" means the aggregate of numbers of departing and arriving passengers

[7] CAGR = Compound Average Growth Rate

iv. Resilience of Forecasts

In the current circumstances of being in the continuing but hopefully later stages and environment of the Covid-19 pandemic, it is reasonable that the appropriateness of the Nelson Airport aviation activity forecasts be questioned and tested, particularly in respect of the potential for air travel demand to be suppressed in the short- and long-term.

Recovery from Covid-19 Pandemic

The impact on air travel activity due to the pandemic has been far more dramatic than previous crises and it is realistic to expect that recovery will be slower and take longer than for previous setbacks.

The domestic travel market in New Zealand has shown strong resilience throughout the pandemic in response to the progressive relaxation of travel restrictions. The impacts of movement restrictions saw capacity within the domestic network drop to as low as 95% of pre-Covid-19 schedules during periods of 2020. However, the New Zealand market was one of the first in the world to experience the rebound of domestic travel with pent-up demand encouraging a strong recovery for domestic air services. Despite ups and downs with various Covid outbreaks and several periods of lockdown, strong recovery trajectories have been evident following each occasion of the easing of restrictions.

International and New Zealand recovery trends provide optimism that a full recovery of pre-Covid-19 traffic levels will occur in this region and world-wide, within 2-3 more years, as border restrictions are progressively lifted (as is now happening in New Zealand) and confidence returns to travellers. There is strong evidence of this, within regions and between countries, where the need for Covid-19 testing and other restrictions on air travel have been removed.

Nelson Airport has shown resilience through the Covid-19 pandemic and it is anticipated that annual passenger numbers will steadily return to pre-Covid-19 levels of more than one million passengers per annum.

In New Zealand, and consequently in Nelson there was a rapid recovery of domestic traffic towards the end of 2020, although flow on from the absence of international visitors nationally still resulted in a reduction in passenger numbers. Through 2021 traffic number rose and fell as restrictions were intially loosened and then another lockdown was applied. With increasing freedoms from restrictions in 2022, domestic traffic numbers have been recovering well, international visitor contributions are starting to have effects, and passenger numbers are approaching or exceeding 2019, pre-Covid-19 levels.

Overall, it is expected that Nelson Airport traffic levels will approach the forecast trend levels set in 2019 by TFI with a possible delay (lag) of some 3-5 years in the early stages of the forecasts, with that lag becoming progressively less pronounced beyond 2030. Accordingly, NAL has retained the TFI forecasts to 2040 and Airbiz extrapolation to 2050, with the understanding that there will likely be a lag of 3-5 years for some of this decade.

Historical Resilience

The system and dynamics of civil aviation as we know it now essentially started after the Second World War with the Convention on International Civil Aviation (in 1944), also known as the Chicago Convention. The International Civil Aviation Organization (ICAO), a specialised agency of the United Nations responsible for coordinating and regulating international air travel, came into effect in 1947.

Since small beginnings, global air traveler numbers have grown steadily and from 1970 an average annual growth rate of between 4-5% has been observed, with remarkable consistency until now, as depicted in Figure 4-5 below.

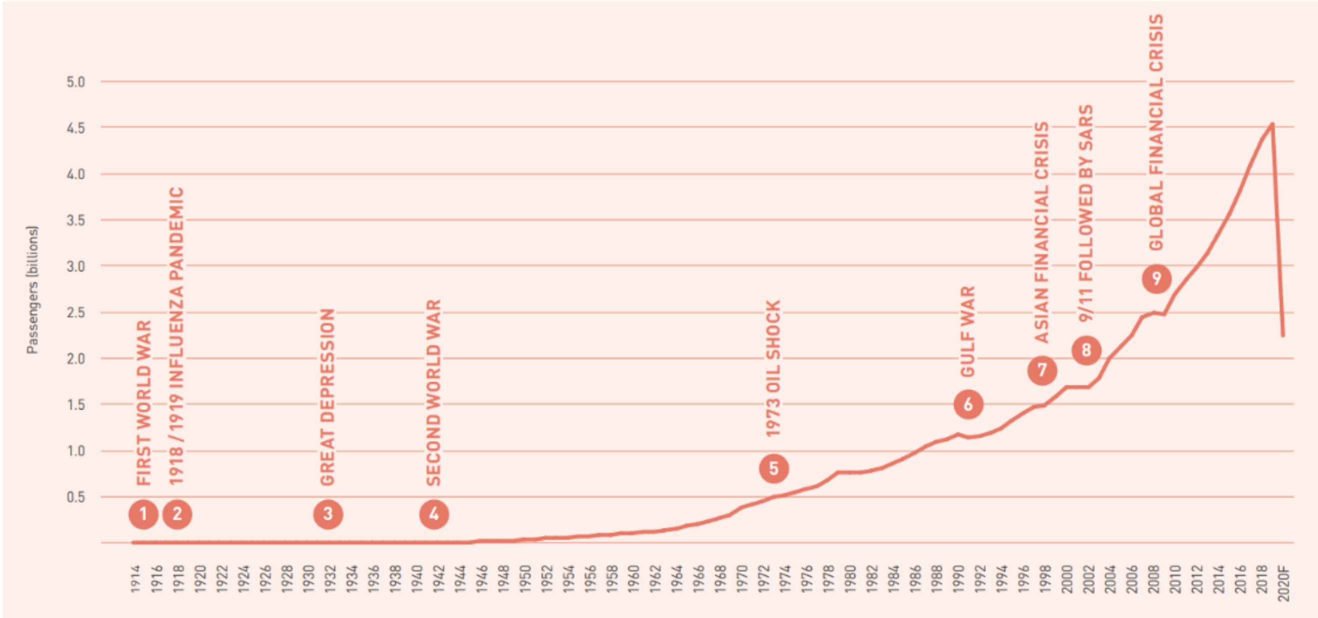


Figure 4-5: Global Annual Air Passengers
Source: ATAG: "Aviation Benefits Beyond Borders, 2020[8]"

Numerous crises have occurred through this time, which have depressed air travel for relatively short periods of time. These various crises have included wars, virus pandemics, terrorism and economic slumps. But in every case, travel levels have quickly recovered to the long-term trends as illustrated in the graphic above.

v. Effects of the Climate Crisis

Aviation, producing 2% of all human-induced CO2, emits less than the iron and steel industry (5%), cement production (4%) and the shipping sector (3%) and around the same as the servers and

[8] ATAG using data from the International Civil Aviation Organization (ICAO) and IATA Economics forecast for 2020.

transmission cables of the internet[9]. In 2008, a global aviation industry-wide action framework was developed by leaders across the aviation sector at the Air Transport Action Group's (ATAG) Aviation and Environment Summit. The framework is based on a set of three goals[10]:

1. Improving fleet fuel efficiency by 1.5% annually from 2009 to 2020. Data released by ATAG suggests that airlines actually achieved a 2.1% average annual improvement between 2009 and 2019.
2. Stabilising net aviation carbon emissions at 2020 levels through carbon-neutral growth; and
3. Reducing net aviation carbon emissions by 50% by 2050, relative to 2005 levels.

A collective and coordinated effort of the entire industry together with governments, oil producers and investors will be required to achieve these goals. Achievement will be under-pinned by:

- Technological innovation,
- Sustainable Aviation Fuels (SAF),
- Operational improvements,
- Infrastructure efficiencies, and
- Market-based measures.

As part of the market-based measures required to achieve the industry climate goals, ICAO has introduced the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) focused on achieving carbon-neutral growth from 2020 onwards. Participation in the scheme is currently on a voluntary basis until 2027, however, over 100 states, including New Zealand, have volunteered to participate in the initial Pilot and First phases. From 2027, participation will become mandatory for most states.

[9] ATAG, "Aviation Benefits Beyond Borders", 2020
[10] ATAG, "Aviation's Climate Action Framework", Fact Sheet #1, 2020

Airline members of IATA have also committed to reducing the contribution of civil aviation to carbon emissions, having passed a resolution in October 2021 committing them to achieving net-zero carbon emissions from their operations by 2050.

From the airport perspective, the Airports Council International (ACI) have set a long-term carbon goal for ACI member airports to reach net zero carbon emissions by 2050, for carbon emissions under the airports direct control.

It is reasonable to conclude that demand for travel through Nelson Airport will not contract, or plateau, but will continue to grow, because of:

- The fundamental human desire of people to travel and connect with others,
- Growth in population of Nelson, New Zealand and markets and destinations that are connected to Nelson,
- Growth in prosperity (GDP),
- Increasing inter-connectiveness of regions and countries, driven by family and business networks, and ethnic diasporas, and
- Travel for business and education – both domestic and international.

This contention is underpinned by evidence of effective action being taken by Nelson Airport, airlines, other airports and the aviation supply chain to achieve the maximum possible contribution to carbon reduction that it can, as early as possible, creating an environment in which air travel is not only broadly tolerated by societies, but prioritised by governments as an effective means of generating the global and local revenues to invest into carbon reduction in other areas and industries.

5. Runway Options Technical Requirements

i. Runway Length Requirements

NAL has decided that jet operations would be excluded from consideration in the planning for a runway extension and that the extended runway length for planning purposes should be what is required to remove operational constraints experienced by existing aircraft and to support the operational needs of future aircraft types.

The Airbiz availability analysis has identified that the optimal practical length for the extended runway on the current airport site, is 1,510m.

ii. Instrument Flight Procedures and Flight Tracks

Aircraft operations to and from airport runways require areas and volumes of airspace clear of obstacles such as terrain, buildings, towers and trees, as well as being clear of other aircraft flight paths.

We have made an assumption that the current terrain obstacle dataset generated from geographic features surrounding the Nelson region, upon which current procedures and flight tracks are based, would still apply for a longer runway provided on the current runway site and alignment, and that current published instrument flight procedures and flight tracks would be feasible with only minor modifications.

iii. Runway Strip

The main runway at Nelson Airport is an instrument runway for non-precision approaches. The runway is classified as a Code 3C runway and is presently contained within a 150m wide runway strip[11].

[11] A runway strip is a defined area including the runway that is intended to reduce the risk of damage to an aircraft running off the runway; and to provide obstacle protection for aircraft flying over the runway strip during take-off or landing.

The classification as Code 3C is based, inter alia, on the length of the runway. Both the current length (1,347m) and a possible longer runway (such as 1,510m) would continue the 3C classification.

The International Civil Aviation Organization (ICAO) document Annex 14 Volume 1, Aerodrome Design and Operation recommends a 280m wide runway strip for Code 3 instrument runways. However, New Zealand standards are defined in the CAANZ Rule Part 139 and Advisory Circular 139-6. While the New Zealand standards are based on the international standards, there are variations between these two documents. In particular, CAANZ Rule Part 139 allows the application of a 150m wide runway strip for Code 3 non-instrument or non-precision approach runways.

NAL has not had specific discussions with CAANZ as whether a 280m runway strip width requirements would ever need to be applied for a Code 3C runway, or if the main runway were to be extended in the future, but it is our expectation that a 150m runway strip width should continue to be regarded by CAANZ as an acceptable means of compliance.

iv. Runway End Safety Areas (RESA)

Runway End Safety Areas (RESA) are graded areas at the end of a runway that are provided to reduce the risk of damage to aircraft in the event of an undershoot, overshoot, or excursion from the runway.

These are explained in the Master Plan Runway Length Availability Analysis report at Appendix A.

Both extension options for extending the current runway include RESAs at each end of a longer runway (240m in length and 150m width).

v. Obstacle Limitation Surfaces (OLS)

OLS are a set of spatially defined surfaces associated with the operations of an aerodrome's runway system. They define the volume of airspace that should ideally be kept free from obstacles to minimise the danger to aircraft during an entirely visual approach or during the final visual segment of an instrument approach procedure.

These are also explained in the **Master Plan Runway Length Availability Analysis report** at **Appendix A**.

Both extension options will need to comply with the requirements for OLS.

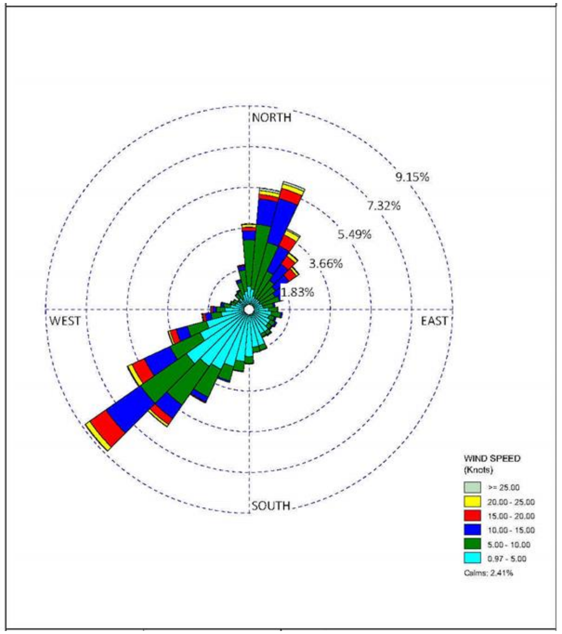


Figure 5-1: Nelson Airport Wind Rose

vi. Runway Alignment

Ideally, a runway should be aligned to optimise operations with consideration of prevailing winds, both direction, strength and prevalence. The wind rose for Nelson Airport is depicted in Figure 5-1 **Error! Reference source not found.**.

On the basis of the information given in the wind rose, the highest and strongest prevalence of winds are from southwest, north and north-northeast geographical directions.

The existing Nelson Airport runway is denoted as 02/20 (a compass heading and is aligned geographically to north-northeast and south-southwest, an optimal alignment for prevailing strong winds that lies centrally within the range indicated by the wind rose analysis. Accordingly, the options to extend the existing runway are also optimal in terms of alignment to prevailing winds.

6. Runway Options Assessment

i. Assessment Process

The assessment process applied to the longer runway options comprises consideration of the relative compliance, suitability, versatility and acceptability of criteria including:

Runway Length

- The ability to implement the optimal 1,510m length.

Physical Restrictions

- Potential physical restrictions from, or on communities adjacent to the airport, in close proximity to the runway ends.

Airspace Implications

- Assessment of the likelihood that instrument flight procedures and flight tracks will be practically able to be designed and implemented with little or no restrictions on payload achievable from the runway length provided.

Integration of Infrastructure and Operations

- Ability to integrate with existing infrastructure and support efficient operations of both scheduled passenger and general aviation operations at Nelson Airport, in particular preserving runway capacity through simultaneous operations on the parallel grass runway, and to enhance safety by maintaining operational separation of these differing aircraft types.

An empirical evaluation scoring process following New Zealand Transport Agency Guidelines[12] has been applied to derive a generalised assessment of the relative merits, or otherwise, of the various criteria.

The evaluation scoring model applied to each assessment is explained in Figure 6-1 below:

Magnitude	Definition	Score
Large positive (+ve)	Major positive impacts resulting in substantial and long-term improvements or enhancements of the existing environment.	3
Moderate positive (+ve)	Moderate positive impact, possibly of short-, medium- or long-term duration. Positive outcome may be in terms of new opportunities and outcomes of enhancement or improvement.	2
Slight positive (+ve)	Minimal positive impact, possibly only lasting over the short term. May be confined to a limited area.	1
Neutral	Neutral – no discernible or predicted positive or negative impact.	0
Slight negative (-ve)	Minimal negative impact, possibly only lasting over the short term, and definitely able to be managed or mitigated. May be confined to a small area.	-1
Moderate negative (-ve)	Moderate negative impact. Impacts may be short, medium or long term and are highly likely to respond to management actions.	-2
Large negative (-ve)	Impacts with serious, long-term and possibly irreversible effect leading to serious damage, degradation or deterioration of the physical, economic, cultural or social environment. Required major rescope of concept, design, location and justification, or requires major commitment to extensive management strategies to mitigate the effect.	-3

Figure 6-1: Assessment Criteria

[12] "Waka Kotahi, New Zealand Transport Agency, Multi-Criteria Analysis: User Guidance", August 2020

ii. Options Considered

Two options for extending the existing runway have been identified and considered:

- Option A: Current runway – north extension to achieve 1,510m runway length (with adjustment to the runway threshold in the south to accommodate the southern RESA). This option is the configuration derived in the Master Plan Runway Length Availability Analysis that resulted in the 1,510m length adoption.
- Option B: Current runway – south extension to achieve 1,510m runway length (with a RESA provided at the north end).

Each of the options is described in the following, to a sufficient level of detail to enable a practical qualitative assessment to be made of the respective merits of each from a range of considerations.

iii. Option A: Current runway – extended north

Option A involves an extension of the existing runway 02/20 northwards by 370m, on land owned by NAL and adjacent non-residential land. The configuration also involves a shortening by 207m to the runway threshold in the south to accommodate the southern RESA).

This option is the configuration derived in the "Master Plan Runway Length Availability Analysis" that resulted in the 1,510m length adoption. The configuration of this option is shown in Figure 6-2 below.

Figure 6-2: Option A, Current Runway Extended North

iv. Option B: Current runway – extended south

The second option considered involves an extension of the existing runway 02/20 by 163m southwards without changes at the northern end, other than provision of a graded area for a RESA, shown in Figure 6-3 below. This achieves a 1,510m long runway by building at the southern end, requires development works outside the current airport site and substantial reclamations of the Jenkins Stream estuary and foreshore area to the south of the Monaco peninsular.

Provision of the RESA area at the northern end would impact on land currently owned by third parties, without actually achieving any longer usable runway in the north.

Figure 6-3: Option B: Current Runway Extended South

v. Comparison of Options

Both options will perform well for all aeronautical assessment criteria as summarised in Figure 6-6 below. The criteria for runway length, airspace and integration would be expected to be fully achieved by both options.

In respect of physical restrictions from or on adjacent communities:

- Both options will be unaffected by existing permanent obstacles, noting that there may need to be alterations made to some “lightweight” obstacles such as aerials or utility poles.
- Both options are unlikely to impose restrictions on permissible development heights for residential properties, notwithstanding that the respective OLS would be closer to houses, in the north for Option A, and in the south for Option B. These are shown indicatively in Figure 6-4 and Figure 6-5 respectively following.

Figure 6-4: Option A, Current Runway Extended North: Indicative OLS

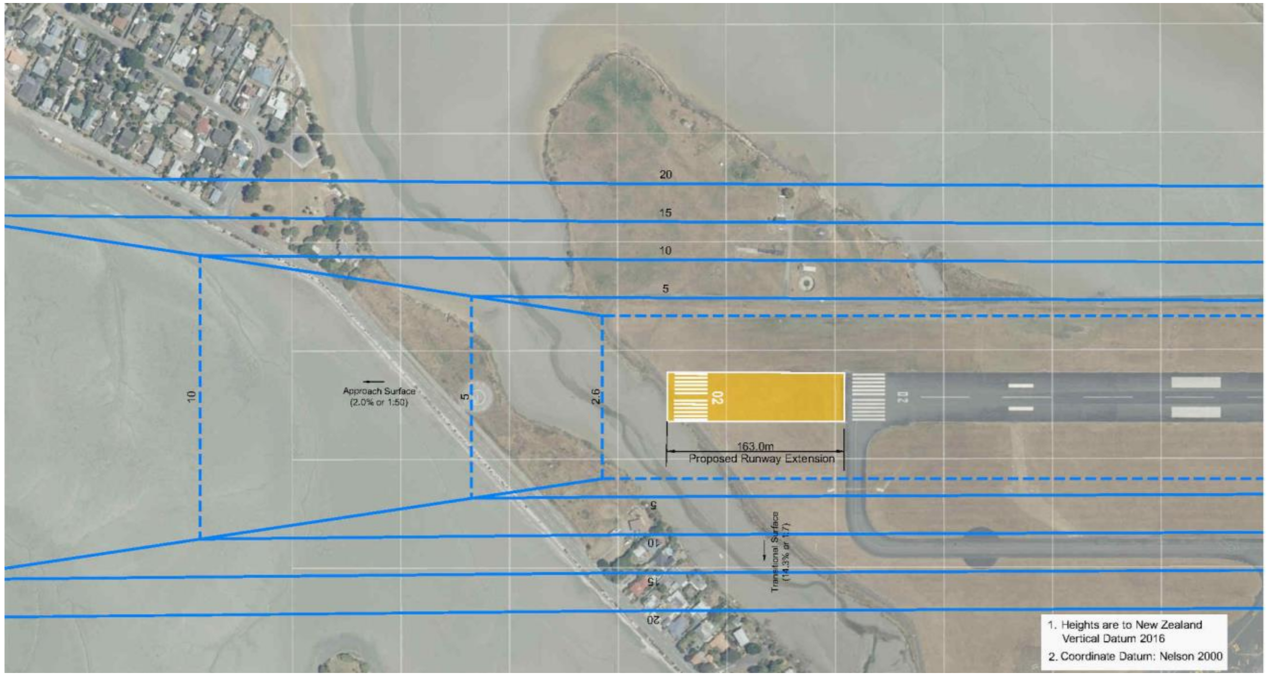


Figure 6-5: Option B, Current Runway Extended South: Indicative OLS

	Option A: Extension to North		Option B: Extension to South	
Consideration	Observation	Assessment Score	Observation	Assessment Score
Runway Length	Target extension length achieved, on airport and golf course land	3	Target extension length achieved, with substantial reclamation in south	3
Physical Restrictions	Unlikely to be increased restrictions for residents north of runway due to OLS being lower	3	Unlikely to be increased restrictions for residents south of runway due to OLS being lower	3
Airspace Implications	Flight paths and procedures unlikely to be materially affected	3	Flight paths and procedures unlikely to be materially affected	3
Integration of Infrastructure and Operations	Integration with existing infrastructure and operations likely to be fully achievable	3	Integration with existing infrastructure and operations likely to be fully achievable	3
Total Score		**12**		**12**

Figure 6-6: Comparative Assessment of Options

In summary, this assessment process that both options score well against the relevant aeronautical criteria set out above.

7. Appendix A:

Runway Length Availability Analysis report, Airbiz

NELSON AIRPORT MASTER PLAN

Runway Length Availability Analysis

FINAL

4 October 2021

AIRBIZ

Table of Contents

1. Introduction

The ability to safely and sustainably operate, maintain, upgrade and extend facilities and infrastructure is vital for Nelson Airport's role in supporting the region's growth, connectivity, resilience and prosperity.

At 1,347m, Nelson Airport's main runway is among the shortest runways in the world catering for Code C aircraft (with a wingspan of 24 to 36m).

Nelson Airport Limited (NAL) has been planning for a runway extension for several years. A runway extension was included in previous Master Plans but is not formally protected in Nelson City Council's resource management plan.

An extended runway and associated planning controls are required so Nelson Airport can continue to provide for current and future aircraft types as well as improve safety related infrastructure. They also ensure that future Airport operations are not unduly constrained by development or intensification occurring around the Airport.

This report presents the analysis of the potential availability of land and airspace to assess the likely practical length for a runway extension to the north.

2. Technical Considerations

i. Runway Strip

The main runway at Nelson Airport is an instrument runway for non-precision approaches. The runway is classified as a Code 3C[1] runway and is presently contained within a 150m wide runway strip[2].

The classification as Code 3C is based, inter alia, on the length of the runway. Both the current length (1347m) and a possible longer runway (such as 1500m) would continue the 3C classification.

The International Civil Aviation Organization (ICAO) document Annex 14 Volume 1, Aerodrome Design and Operation recommends a 280m wide runway strip for Code 3 instrument runways. However, New Zealand standards are defined in the Civil Aviation Authority of New Zealand (CAANZ) Rule Part 139 and Advisory Circular 139-6. While the New Zealand standards are based on the international standards, there are variations between these two documents. In particular, CAANZ Rule Part 139 allows the application of a 150m wide runway strip for Code 3 non-instrument or non-precision approach runways.

NAL has not had specific discussions with CAANZ as whether a 280m runway strip width requirements would ever need to be applied for a Code 3C runway, or if the main runway were to be extended in the future, but it is our expectation that a 150m runway strip width should continue to be regarded by CAANZ as an acceptable means of compliance.

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[1] A Code 3C runway is a runway with reference length 1200 m up to but not including 1800 m, serving aircraft with wingspan 24m up to but not including 36m

[2] A runway strip is a defined area including the runway that is intended to reduce the risk of damage to an aircraft running off the runway; and to provide obstacle protection for aircraft flying over the runway strip during take-off or landing.

ii. Runway End Safety Areas (RESA)

Runway End Safety Areas (RESA) reduce the risk of damage to aircraft in the event of an undershoot, overshoot, or excursion from the runway. RESAs should be constructed of solid material, graded to support an aircraft and rescue fire-fighting appliances.

CAANZ does not currently require RESAs for the existing runway at Nelson Airport and RESAs have not been declared in Nelson Airport's existing runway configuration. This is allowed under the conditions set out in Civil Aviation Rule 139.51 (b). However, under this rule, any increase in the length of the main runway exceeding 15m would trigger a requirement for RESAs. Land provided for such RESAs would need to be provided within the proposed core Airport precinct and must be under Nelson Airport's control.

The dimensional requirements for RESA are given in Civil Aviation Rule 139 and are shown below.

A.1 Physical characteristics for RESA

(a) A RESA must extend—

(1) to a distance of at least 90 metres from the end of the runway strip, and

(2) if practicable—

(i) to a distance of at least 240 metres from the end of the runway strip; or

(ii) to the greatest distance that is practicable between the 90 metres required in paragraph(a)(1) and the 240 metres required in paragraph (a)(2)(i).

(b) The width of a RESA must—

(1) be at least twice the width of the associated runway and be positioned symmetrically on either side of the extended centre line of the runway; and

(2) where practicable, be equal to the width of the graded portion of the associated runway strip.

Based on section (a) (2) (ii) a length of 240m has been adopted. Based on section (b) (2) a width of 150m has been adopted.

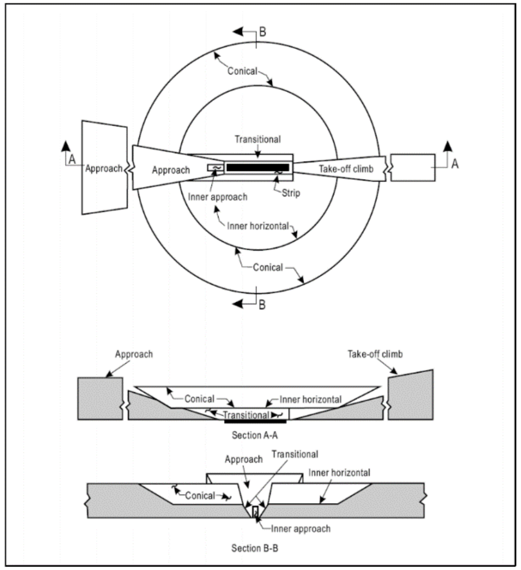
iii. Obstacle Limitation Surfaces (OLS)

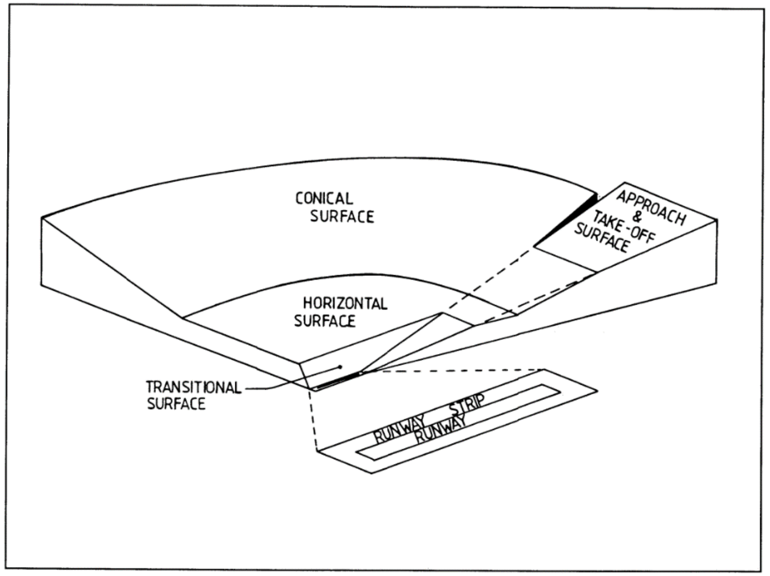
Obstacle Limitation Surfaces (OLS) are a set of spatially defined surfaces associated with the operations of an aerodrome's runway system. They define the volume of airspace that should ideally be kept free from obstacles to minimise the danger to aircraft during an entirely visual approach or during the final visual segment of an instrument approach procedure. These surfaces are of a permanent nature and are based on the location and height of the airport reference datum and associated runways. Anything protruding above the vertical limits of the OLS is regarded as an obstacle.

Some penetrations of the OLS are permissible if a safety case assessment is approved, but the assessment would need to prove that the obstacle(s) does not interfere with the safety, efficiency or regularity of existing or future operations at an airport. This is a matter for the CAANZ to determine. In some cases, approval may be granted with conditions, such as a requirement to mark and/or lighting of the obstacle in a particular way. The OLS that must be established for a runway include:

- Conical surface
- Inner horizontal surface
- Approach surface
- Transitional surfaces
- Take-off climb surface

These surfaces are illustrated below.





Sources: CAANZ AC139-6

Of most significance for the assessments in this report will be the potential constraints that might be imposed by obstacles generally along the extended centreline of a runway, i.e. beneath the Approach surface.

Under New Zealand Civil Aviation regulations for a Code 3C domestic runway servicing aircraft with Maximum Take-off Weight (MTOW) greater than 22,700kg (includes current Air New Zealand ATR72-600[3] and potential future types), the Approach Surface rises at a slope of 1:40 (2.5%) from the end of the runway strip, starting at 150m width and diverging wider at 1:10 each side[4].

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[3] Air New Zealand ATR72-600 MTOW = 23,000kg

[4] CAANZ Advisory Circular AC139-6, Table 4-1

However, the Take-off Climb Surface should be assessed at a slightly shallower gradient of 1:50 (2%).

Accordingly, it was decided to apply a common 1:50 (2%) gradient slope for the Approach and Take-off Surfaces.

3. Runway Extension Length Availability

i. Assessment Methodology

To determine how long the main Runway 02/20 could be extended the to the north (Runway 20 end) the adopted approach was to identify the critical constraint from either:

1. The ability to secure land which could accommodate a configuration with a 150m wide RESA to the north of the extended runway, starting at the north end of the runway strip, extending a further distance of 240m; or
2. The ability to accommodate the northern Approach/Take-off Surface, starting at the north end of the runway strip, rising to the north at a slope gradient of 1:50.

It was found that the Approach Surface-Obstacle constraints were the more critical criterion resulting in a shorter runway extension availability than the RESA distance constraint. Accordingly, the following material describes only the Approach/Take-off Surface-Obstacle constraints assessment and findings.

The method followed was to:

Step 1: Identify the critical fixed obstacle

Tasman Gowland Surveyors were engaged by NAL to survey and identify the locations and elevations of a wide range of potential obstacles under and near the extended centreline of the runway, to the north. The data that they provided was used by Airbiz to assess the effect of obstacles that would limit the position of the northerly Approach/Take-off Surface.

Based on the obstacles' elevations and proximity to the runway threshold, the assessment identified the obstacle which would "first" penetrate the Approach/Take-off Surface as the runway was extended and the Approach/Take-off Surface translated northwards.

The analysis only considered buildings; not trees nor utilities, on the basis that utilities such as power poles and light poles could readily be removed and that trees could be trimmed, although acknowledging the process of lowering trees could be more difficult than lowering utilities.

Step 2: Extend runway to the obstacle

The extended Runway 20 threshold was then positioned 60m inside the end of the runway strip so that the critical obstacle would just avoid penetrating the Approach/Take-off Surface.

The elevation of the Runway 20 threshold was adopted at 3.80m above New Zealand Vertical Datum 2016. This assumption was taken from earlier work which considered the grade of the existing runway and future seal overlays[5].

Two scenarios were considered. The first is the runway extension available based on existing obstacles. The second is the runway extension available if the closest obstacles were removed.

Step 3: Confirmation of obstacle penetrations for extended runways

Airbiz provided the coordinates of the proposed relocated Runway 20 threshold to Tasman Gowland Surveyors to confirm the obstacle penetrations.

This step confirmed that the correct obstacle in each scenario was identified by Airbiz as the critical obstacle and that no buildings close to the runway end penetrated the Approach/Take-off slope.

ii. Scenario 1 – Existing Obstacles

The critical existing obstacle that was identified is the chimney of the dwelling at 119 Parkers Road. The available runway extension based on this obstacle is an additional 162m. The following drawing, Figure 3-1, shows this runway extension in relation to the critical obstacle.

[5] OLS Survey for extension to Runway 02-20 with 2.0% Take-off and Approach Surfaces, 7 November 2019, prepared by Tasman Gowland Surveyors Ltd. (2% slope Report 2019 Extension OLS.pdf)

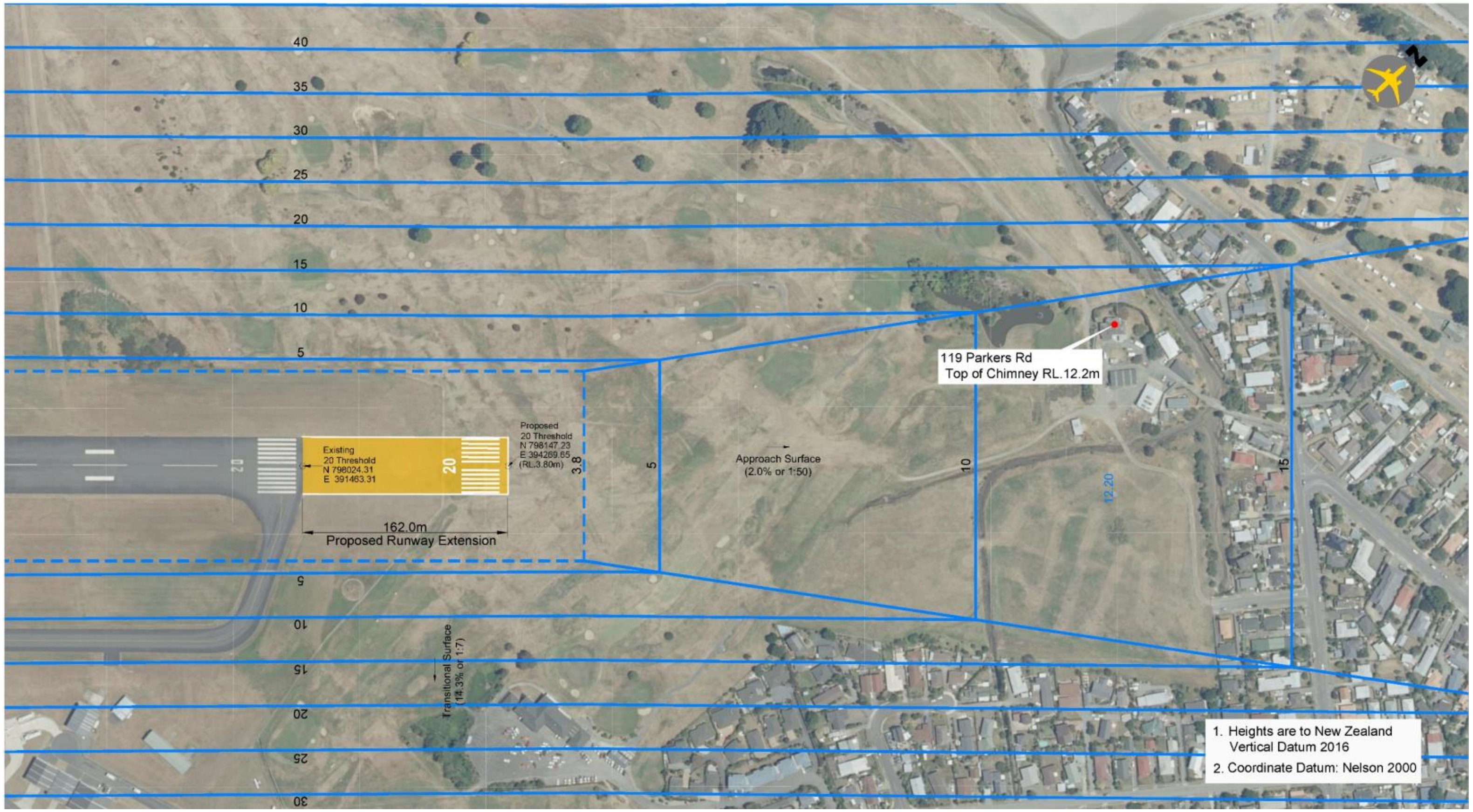


Figure 3-1 Runway Extension Based on Existing Obstacles

iii. Scenario 2 – Removing Obstacles at 119 Parkers Road

There are a range of buildings at and adjacent to 119 Parkers Road including grounds keeping sheds for the Nelson Golf Club. Assuming all these buildings are removed, the next critical obstacle that was identified is the chimney of the dwelling at 89 Golf Road. The available runway extension based on this obstacle is an additional 370m.

A Runway 20 extension of 370m would result in penetrations of the Approach/Take-off Surface of two TV aerials. The roofs which these aerials are mounted at 91 Golf Road and 2/142 Parkers Road would not penetrate the Approach/Take-off Surface. Therefore, it is our view that these TV aerial obstacle penetrations could be resolved.

The following drawing, Figure 3-2, shows this runway extension in relation to the critical obstacle.

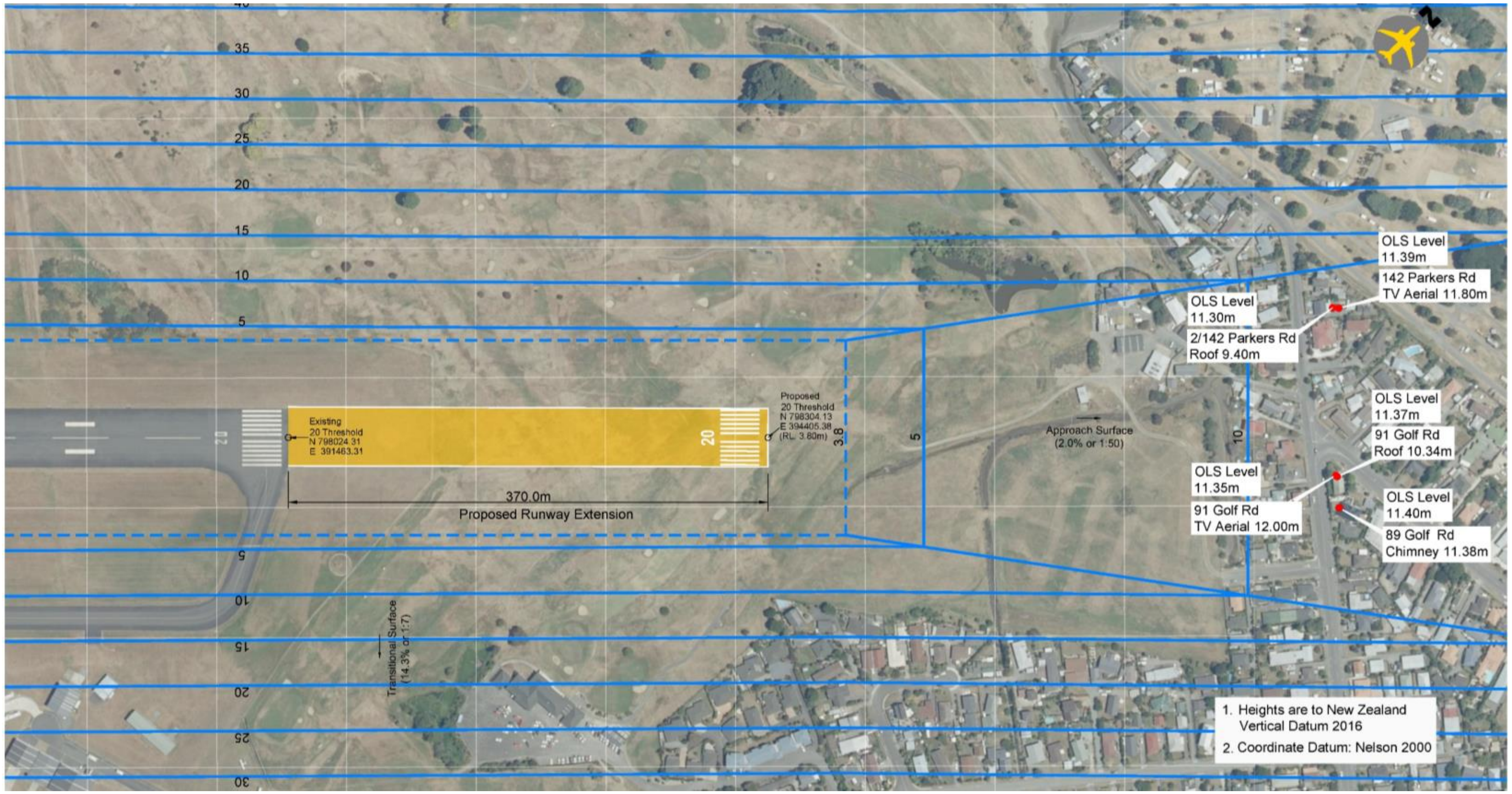


Figure 3-2 Runway Extension Based on Chimney of 89 Golf Road

iv. RESA at south end of the Runway

A RESA would also need to be provided at the southern end of the runway (02 end) on Airport land, in the event of a runway extension (greater than 15m). There is presently insufficient distance available between the airport southern boundary and the southern end of the runway strip to accommodate a 240m long RESA. Airbiz assessed that the southern end of the runway would need to be displaced northwards (shortening the runway) by a distance of 207m, as shown below.

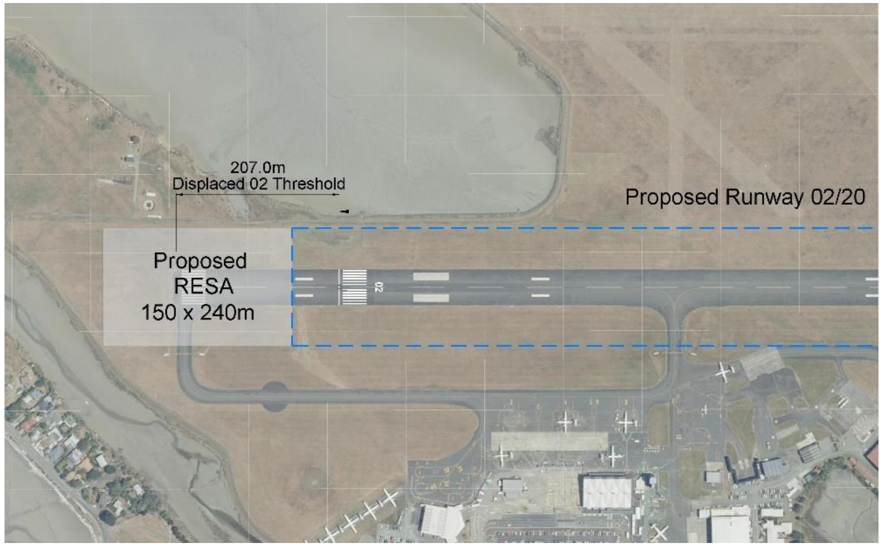


Figure 3-3 Runway shortening to accommodate southern RESA

v. Extended Runway Lengths – by Scenarios

Considering the potential northern extension lengths for the two scenarios described above (162m and 370m respectively) with the offsetting shortening of the runway to accommodate the southern RESA, results in two possible outcomes for runway extension length availability, as summarised below.

	Scenario 1 Existing obstacles	Scenario 2 Removing Obstacles at 119 Parkers Road
Northern extension achievable (constrained by obstacles)	162m	370m
Southern shortening of runway (to accommodate RESA)	-207m	-207m
Net extension achievable	-45m	163m
Resulting Runway Length Achievable (added to existing length 1347m)	1,302m	1,510m

This shows that Scenario 1 would result in a shorter runway that at present and therefore is impractical. Scenario 2 would produce a runway 163m longer than current, achieving an extended length of 1,510m.

Therefore, **to achieve a useful runway extension and provide RESAs the existing obstacles at and around 119 Parkers Road must be removed.**

Adopting the Runway 20 threshold move of 370m as shown in Figure 3-2 above results in a runway length of 1,510m as shown in Figure 3-4 below.

Figure 3-4 Runway Extension Availability with RESAs

8. Appendix B:

Nelson Airport Traffic Forecasts report, TFI

Nelson Airport Traffic Forecasts

TFI Report for Nelson Airport Limited

December 2019

Contents

Traffic Forecasts for Nelson Airport

1. Passenger Forecasts

The traffic forecasts in this Report were prepared by Tourism Futures International (TFI) with the assistance of management of Nelson Airport and Lime Intelligence. The original forecasts were prepared in June 2019 based on early 2019 data and economic forecasts. In September 2019 Jetstar announced that it was to withdraw from regional flying in New Zealand (its Q300 turboprop services) at the end of November 2019. The forecasts in this Report have been modified to take this into account.

The main driver for traffic forecasts over the period to FY22 is the estimated capacity changes following Jetstar's withdrawal from regional New Zealand. In the longer-term the drivers include growth in New Zealand GDP per capita, assumed changes in New Zealand domestic airfares, changes in the Tasman and Nelson regional populations, and forecast growth in international visitors to New Zealand.

The forecasts are summarised in **Table 1.1** and are presented in **Figure 1.1.** Three levels of forecasts have been prepared:

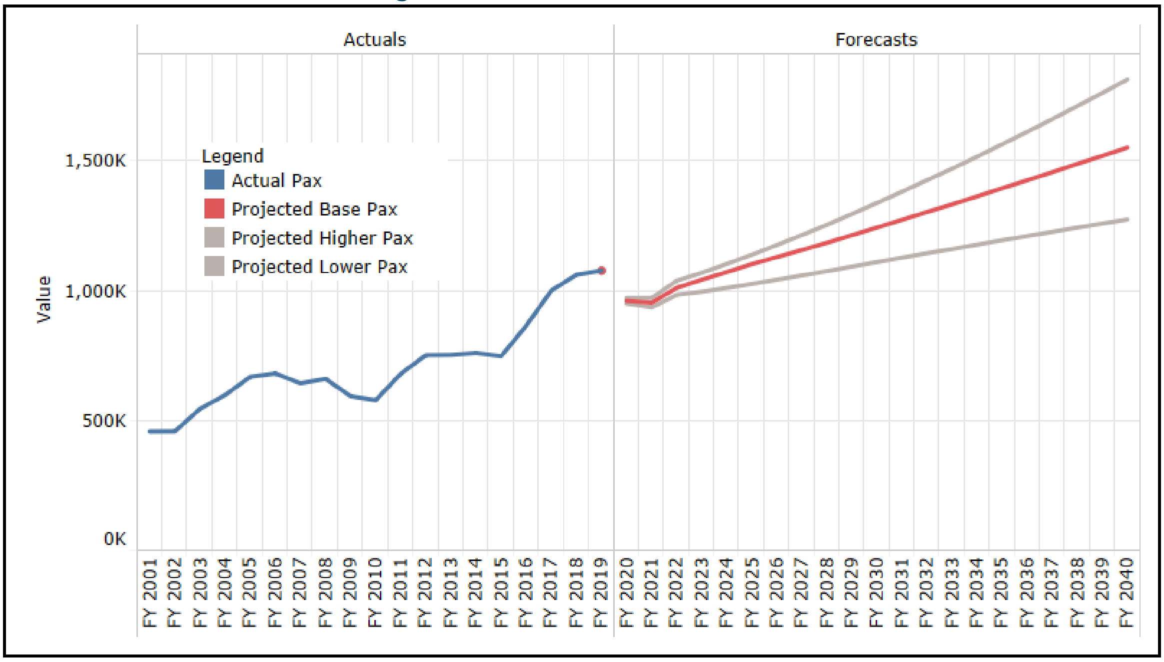
- Base forecasts with most likely capacity changes for the next few years and 'Central' forecasts for economic and other factors.
- High Scenario forecasts with stronger capacity assumptions (than for the Base forecasts) for the next few years and with GDP growing at 0.5 percentage points higher than the Base forecasts and fares falling by 0.5 percentage points annually relative to the Base.
- Low Scenario forecasts with weaker capacity assumptions relative to the Base forecasts for the next few years and with GDP growing at 0.5 percentage points lower than the Base forecasts and fares growing by 0.5 percentage points annually relative to the Base.

Table 1.1: Passenger Forecast Variants for Nelson Airport
– Actual Passengers to FY19 and Forecasts for FY20 to FY40

Years end 30 June	Actual Pax	Base Case	High Scenario	Low Scenario
2014	759			
2019	1,077	1,077	1,077	1,077
2020		961	971	950
2021		953	971	935
2022		1,011	1,038	983
2023		1,042	1,068	996
2024		1,071	1,103	1,010
2025		1,102	1,138	1,025
2030		1,243	1,337	1,109
2040		1,551	1,813	1,274
CAGR				
2014 to 2019	7.2%			
2019 to 2025		0.4%	0.9%	-0.8%
2025 to 2040		2.3%	3.2%	1.5%

Source: TFI forecasts, actual data from Nelson Airport

Figure 1.1: Passenger Forecast Variants for Nelson – Actual Passengers to FY19 and Forecasts for FY20 to FY40



Source: TFI forecasts, actual data from Nelson Airport.

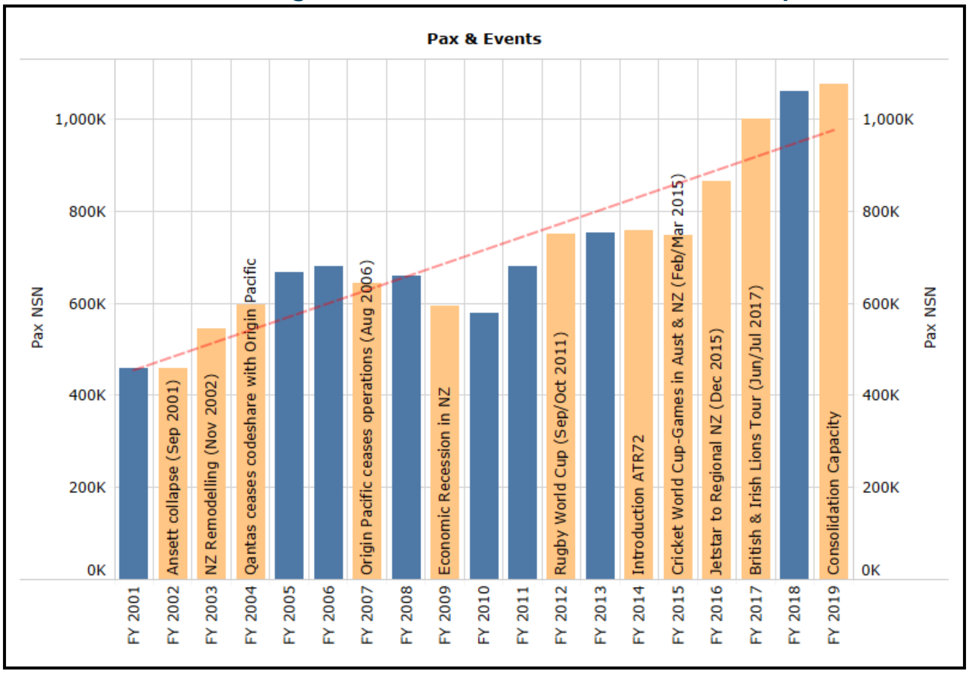
2. Traffic Review

TFI has collated traffic data as part of its preparation of Nelson Airport forecasts.

Figure 2.1 shows, for the period FY01 to FY19, annual passenger movements and significant events influencing passenger outcomes across New Zealand. The major developments have included:

- FY 2003: Air New Zealand's short haul 'remodelling' including fleet upgrades (from November 2002).
- FY 2004: Qantas ceases codeshare with Origin Pacific early in 2004.
- FY 2007: Origin Pacific ceases operations (August 2006).
- FY 2009: Economic recession in New Zealand.
- FY 2014: Introduction of the Air New Zealand ATR72s to Nelson/Auckland route.
- FY 2015: Cricket World Cup-Games in Australia and New Zealand (over February and March 2015).
- FY 2016: Jetstar commences services to Regional New Zealand (from December 2015).
- FY 2017: British and Irish Lions Tour (throughout June and into early July 2017).
- FY 2019: Consolidation of capacity - Air New Zealand cutting capacity across its domestic network.

Figure 2.1: Annual Passenger Movements and Events, Nelson Airport FY01 to FY19



Source: TFI based on Nelson Airport data.

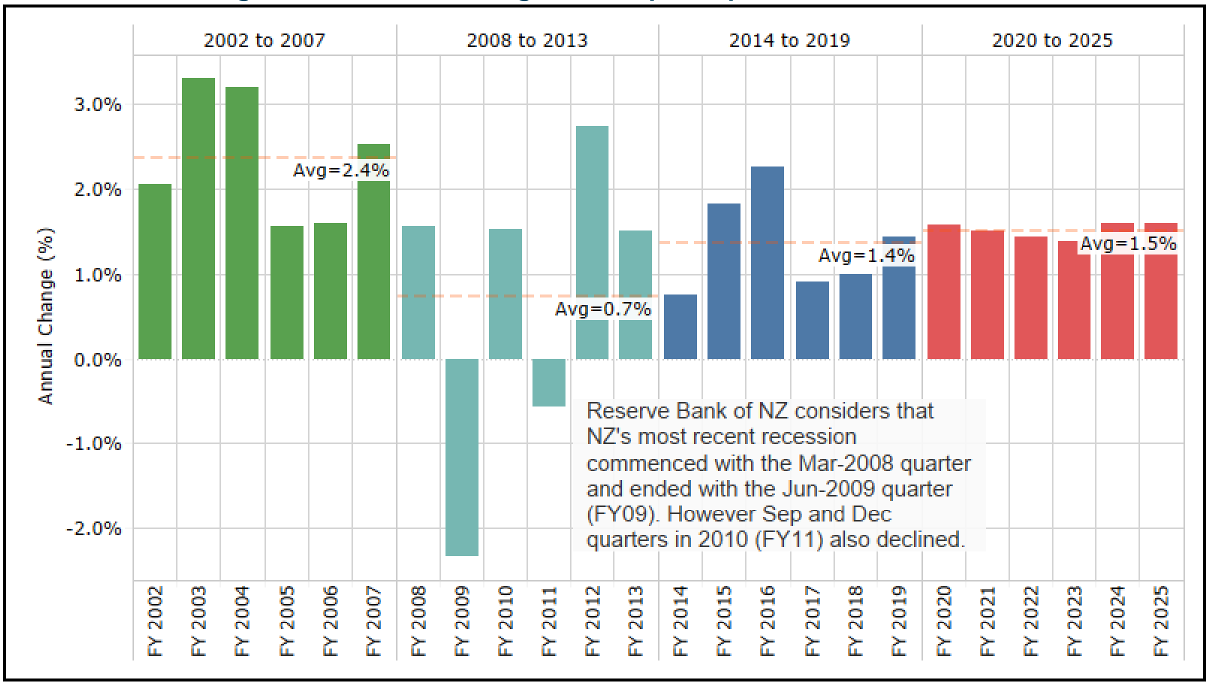
3. Economic Environment

Economic forecasts continue to show growth globally although risks are increasing on the downside:

- Global outlook:
  - Economic prospects are now weaker in nearly all G20 countries than previously anticipated. Vulnerabilities stemming from China and the weakening European economy, combined with a slowdown in trade and global manufacturing, high policy uncertainty and risks in financial markets, could undermine strong and sustainable medium-term growth worldwide.
  - Trade growth has slowed with trade restrictions having adverse effects on confidence and investment plans around the world.
  - For China risks remain of a sharper slowdown that would hit global growth and trade prospects.
- For New Zealand - the Treasury, Reserve Bank and private forecasters point to several factors that could slow growth in addition to the global factors:
  - The rate of consumption growth is slow relative to recent years, owing to a continued slowing in population growth and lower house price inflation.
  - A range of forces have deteriorated over the past years and these could impact negatively on business investment. These factors include the exchange rate, the terms of trade, financial market conditions, business confidence and profitability.

Figure 3.1 shows for New Zealand, the annual change in GDP per Capita over the period FY02 to FY19, with forecasts to FY25. The most recent five-year period showed a recovery from the prior FY08 to FY13 period which included the Global Financial Crisis (GFC) and New Zealand recession. Forward growth is forecast to be steady at around 1.5% annually to FY25, although there are growing downside risks during this period, and 2.6% annually beyond.

Figure 3.1: Annual Change in GDP per Capita for New Zealand



Source: TFI based on Statistics NZ data, compilation of economic forecasters.

4. Population

Population projections for New Zealand as a whole and for regions are summarised in **Table 4.1**. Note that there is an expectation of a slowing in growth rates relative to the past five years and this has significant implications for economic growth and development.

Growth for the Tasman and Nelson regions slows from the 1.1% per year over 2013 to 2018 to an average 0.7% annually for 2018 to 2023 period and 0.6% over 2023 to 2038.

Table 4.1: Population Projections for New Zealand

At 30 June	NZ	Tasman region	Nelson region	Tasman +Nelson	Total, North Island regions	Total, South Island regions
2013	4,442,100	48,800	48,700	97,500	3,398,700	1,042,800
2018	4,864,600	51,300	51,800	103,100	3,734,200	1,129,900
2023	5,157,900	53,000	53,700	106,700	3,970,900	1,186,300
2038	5,769,800	55,800	57,400	113,200	4,478,700	1,290,500
CAGR						
2013 to 2018	1.8%	1.0%	1.2%	1.1%	1.9%	1.6%
2018 to 2023	1.2%	0.7%	0.7%	0.7%	1.2%	1.0%
2023 to 2038	0.8%	0.3%	0.4%	0.6%	0.8%	0.6%

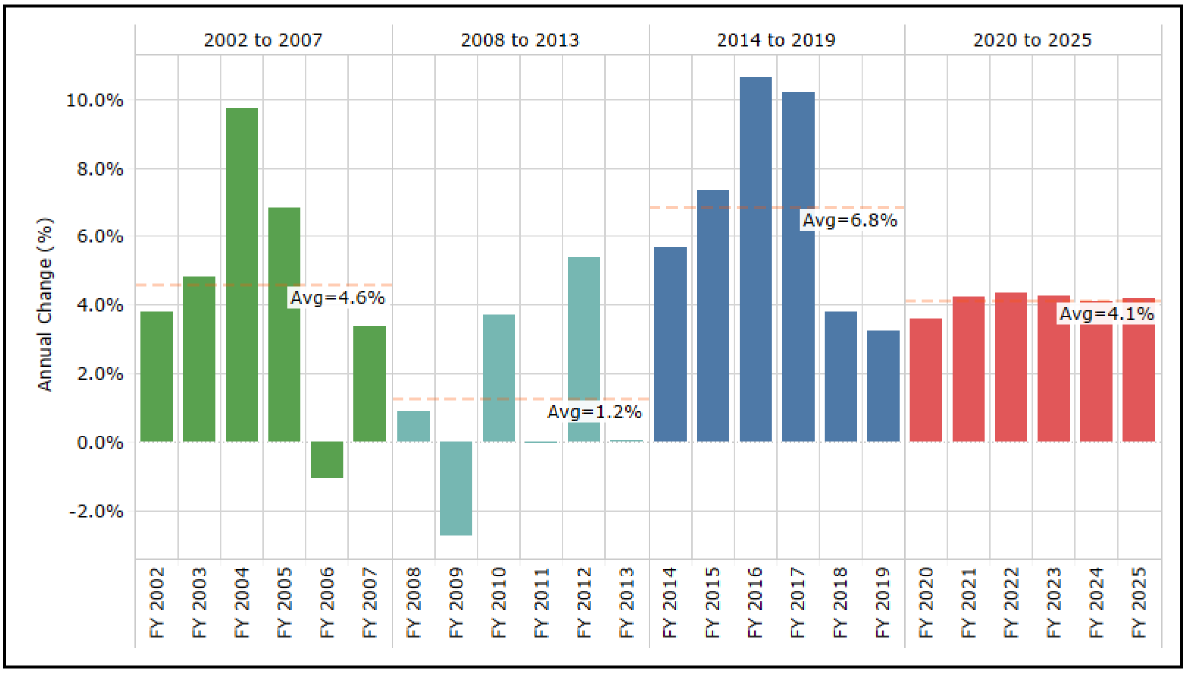
Source: Statistics NZ, Medium projection.

5. International Tourism

Most recent visitor forecasts for New Zealand prepared by the NZ Ministry of Business, Innovation and Employment (MBIENZ) have visitor arrivals to New Zealand reaching 5.1 million visitors in 2025 – up from 3.9 million in 2018. Australia will continue as the largest market – growing from 1.5 million visitors in 2018 to 1.8 million in 2025.

Figure 5.1 shows the annual growth rates in numbers of visitor arrivals for New Zealand over the past 18 years and the forecast annual growth rates to 2025. Growth fluctuated in the 2008 to 2013 period as the global economy recovered from the GFC. Growth over 2014 to 2019 recovered and the average for 2020 to 2025, at 4.1%, is modest by comparison. TFI has assumed international visitor numbers average growth of 3.2% per year for the period FY26 to FY40.

Figure 5.1: International Visitors to New Zealand, Year-end December, FY19 estimate, Forecasts 2020 to 2025

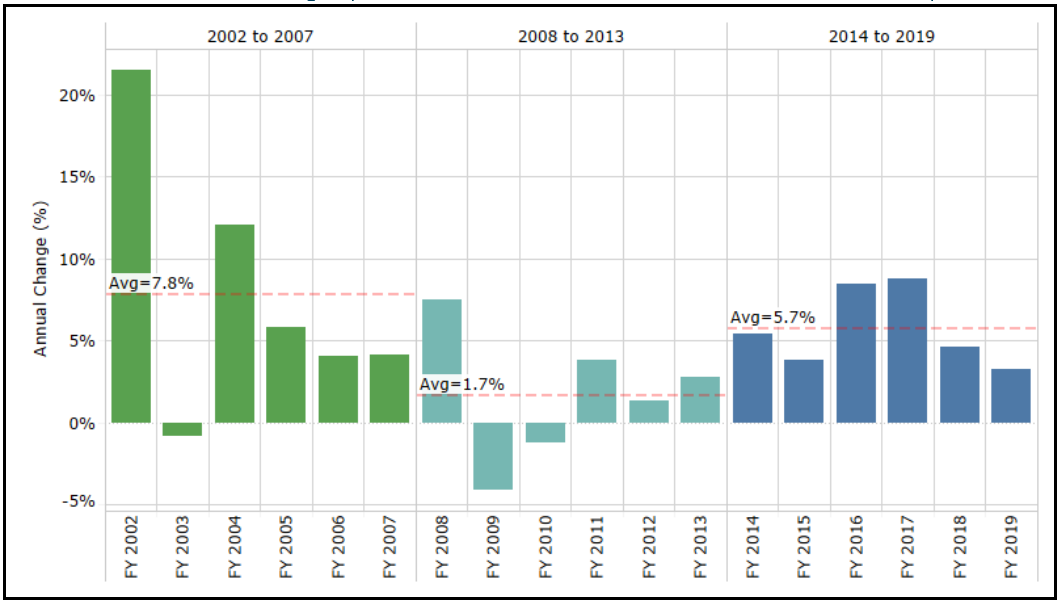


Source: TFI based on Statistics NZ data and MBIENZ forecasts.

6. NZ Domestic Capacity Environment

A compilation of Air New Zealand data of Available Seat Kilometres (ASKs) over the period FY02 to FY19 is shown in **Figure 6.1**. Strong growth through FY02-FY07 gave way to slower growth for the period FY08-FY13. In the most recent period, growth averages 5.7% per year. The expectation is that the next few years will see some consolidation and slowing in capacity growth nationally.

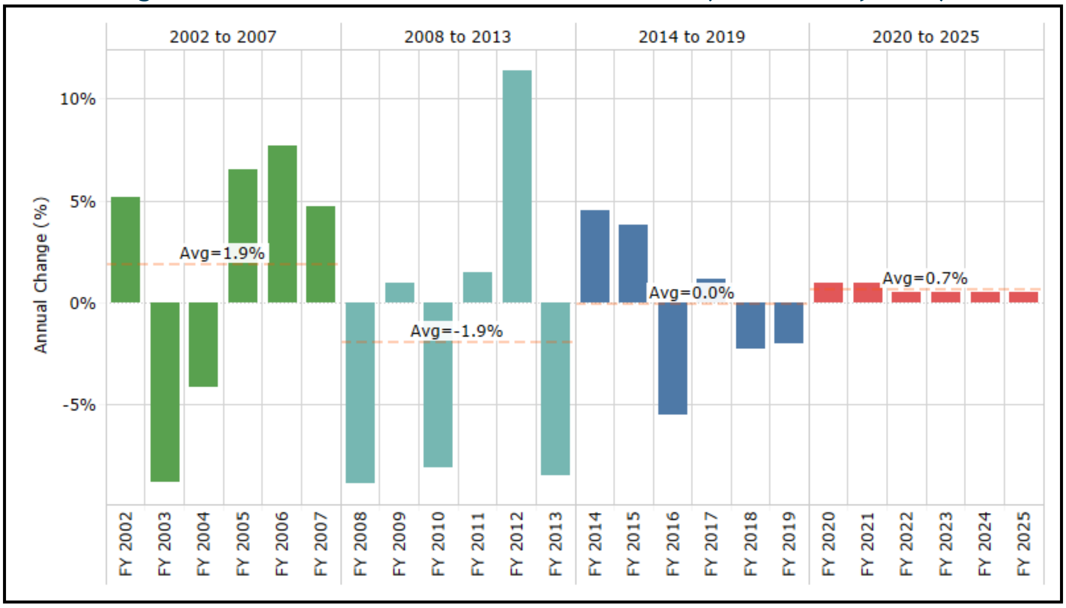
Figure 6.1: Air New Zealand Domestic Capacity (ASKs) - Annual Change (Note FY19 Based on Year to Date March 2019)



Source: TFI based on Air New Zealand data.

Figure 6.2 shows the annual change in real airfares as measured by Statistics New Zealand as part of its CPI series. TFI is continuing its analysis of the relationship between oil prices, airline capacity and fares. However, it is likely that as capacity is constrained, over the next few years airfares will increase.

Figure 6.2: Domestic CPI – Domestic Air Travel (Inflation Adjusted)



Source: TFI based on Statistics New Zealand data.

Air New Zealand has reported that during the first half of the 2019 financial year (six months to December 2018):

- Domestic capacity (in ASKs) grew by 2.9% on the same period FY18 with increased frequency on domestic main trunk routes such as Auckland to Queenstown and Dunedin contributing to the growth.
- Around 3% growth was expected in the second half of FY19, reflecting increased services into Dunedin and Queenstown, along with regional growth driven by additional services to Palmerston North and Tauranga, and growth in regional routes to/from Christchurch.
- Mid-year had seen a softening of demand growth in the domestic leisure segment from high single digits to around 4%.

The latest data available is for the 10-month period to April 2019, showing 3.3% growth in domestic capacity over the same period 2018.

In its May 2019 investor update, Air New Zealand reported that total domestic capacity was expected to slightly down by around 1% in the coming year as it makes frequency adjustments into Queenstown, Christchurch and Wellington (outweighing growth from new jet services going from Auckland to Invercargill).

In narrow-body and regional fleet adjustments, Air New Zealand:

- Added three A321 NEOS (including two leased) to its fleet during the 1H FY19 (for the Tasman and Pacific Islands network), along with two ATR72-600 turboprops (one ATR72-500 exited the fleet).
- In a March 2019 review of its network, fleet and cost base, announced the deferral of delivery times for some of the aircraft on order, reflecting a slower than expected demand growth environment. This included the deferral by one year, from 2020 to 2021, of the delivery of first three A321neo aircraft for the domestic network. Seven A321neos are expected to be operated on domestic routes in total, with two more to be delivered in 2022 and two in 2024.
- In a May 2019 amendment, the aircraft delivery schedule shows a delay in delivery of the last of the seven ATR72-600s still on order, from FY20 to FY21. Previously all had been scheduled for delivery by the end-FY20 (at the same time as the last of the smaller -500s leave the fleet).

In September 2019 Jetstar announced that it was to withdraw from regional flying in New Zealand (its Q300 turboprop services) at the end of November 2019. Jetstar commenced flying to the regional centres in December 2015 and at the time of the announcement offered up to 130 return services a week during the peak season across five routes – Auckland and Nelson, Napier, New Plymouth and Palmerston North and flights between Nelson and Wellington. The forecasts in this Report have been modified to take this into account.

7. Aircraft Movement Forecasts

Two major categories of aircraft movement forecasts have been prepared. The first is for scheduled passenger-carrying aircraft. Assumptions for average passenger seat factors and the average number of seats per movement determine the average number of passengers per movement. Passenger forecasts are divided by the average number of passengers per movement to determine the forecasts.

The second category of movement is general aviation and includes non-scheduled aircraft movements, other general aviation movements with fixed-wing aircraft and helicopter movements. Data on this second category of movements is limited.

Central and High variants have been developed (**Tables 7.1** and **7.2**). Two versions of each forecast have been prepared – the first, Version (a) in **Table 7.1** below, assumes no jet aircraft enter the Nelson routes over the forecast period. The second, Version (b) in **Table 7.1** below assumes the entry of Jet aircraft on the Auckland-Nelson route from FY36.

The average number of passengers per movement is assumed to increase from 42 in FY19 to 48 by FY40 for Version (a) and to 51 by FY40 for Version (b).

Table 7.1: Aircraft Movement Forecast Variants for Nelson Airport – Central Forecasts

	Central Forecast				
	Scheduled Passenger Movements - No Jet Aircraft (a)	**Scheduled Passenger Movements - With Jet Aircraft (b)**	**Other General Aviation**	**Total Movements (a)**	**Total Movements (b)**
	'000s Movements				
FY19 Estimate	25.4	25.4	11.9	37.3	37.3
FY25	24.8	24.8	12.3	37.0	37.0
FY30	27.2	26.5	12.5	39.7	39.1
FY40	32.6	30.4	12.8	45.5	43.2
	CAGR				
2019 to 2025	-0.4%	-0.4%	0.5%	-0.1%	-0.1%
2025 to 2040	1.2%	0.9%	0.2%	0.9%	0.7%

Source: TFI forecasts, FY19 estimated data from Nelson Airport

Table 7.2: Aircraft Movement Forecast Variants for Nelson Airport – High Forecasts

	Central Forecast				
	Scheduled Passenger Movements - No Jet Aircraft (a)	**Scheduled Passenger Movements - With Jet Aircraft (b)**	**Other General Aviation**	**Total Movements (a)**	**Total Movements (b)**
			'000s Movements		
FY19 Estimate	25.4	25.4	11.9	37.3	37.3
FY25	25.6	25.6	12.3	37.8	37.8
FY30	29.3	28.6	12.5	41.8	41.1
FY40	38.2	35.5	12.8	51.0	48.3
			CAGR		
2019 to 2025	0.1%	0.1%	0.5%	0.2%	0.2%
2025 to 2040	1.8%	1.5%	0.2%	1.3%	1.1%

Source: TFI forecasts, FY19 estimated data from Nelson Airport

Disclaimer

The Forecasts described in this Report have been prepared on behalf of, and for the exclusive use of, the Client and are not intended for third parties. TFI accepts no liability or responsibility whatever for or in respect of any use of or reliance upon this report by any third party.

Accordingly, TFI provides the Forecasts on the understanding that: -

1. The business environment is uncertain and that forecasting provides a guide only in respect of the planning for passenger and aircraft movements at Nelson Airport. Forecasts are based on a number of economic and other assumptions and must be interpreted in the context of these assumptions;
2. TFI disclaims all and any liability to any person in respect of anything and of the consequences of anything done or omitted to be done by any such person in reliance, whether whole or partial, upon the whole or any part of the Forecasts;
3. TFI is neither responsible for the accuracy of the Forecasts, nor makes any representations nor assumes any duty of care in respect of any of the Forecasts;
4. TFI will not be liable in contract, tort or otherwise for any damages expense, loss or liability suffered or incurred by the Client however caused in respect of the Forecasts;
5. The Client will not rely upon any of the Forecasts in entering into any contract or other arrangements;
6. The Forecasts will be developed solely for use by the Client and not for the use of third parties; and
7. In the event that all or part of the Forecasts are provided by the Client to any third party, the Client will assume responsibility for ensuring that the third party accepts the Forecasts on the same basis as described in (1)-(6) above.