

New Zealand Transport Outlook
Origin and Destination-Based International Air Passenger Model
November 2017

Short name

International Air Travel Forecasting Model

Purpose of the model

The Transport Outlook Origin and Destination-Based International Air Passenger Model projects international air passenger flows from each region in New Zealand for the years 2018, 2023, 2028, 2033, 2038, and 2043.

Software used

Excel

For questions and comments:

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Transport Outlook Origin and Destination-Based International Air Passenger Model

1. At a high level, what does this model do?

The Transport Outlook Origin and Destination-Based International Air Passenger Model projects international air passenger flows from each of the regions in New Zealand for the years 2018, 2023, 2028, 2033, 2038, and 2043. However, New Zealand residents leaving for permanent/long-term migration are not included due to unavailable data. The projections are based on certain assumptions, including New Zealand population by region, GDP, and overseas visitor arrivals. There are 15 regions in the model, with Tasman and Nelson treated as a single region. The Bay of Plenty region has been split into Tauranga and Rotorua, and the Otago region into Queenstown and Dunedin, given the distinctive market characteristics of Rotorua and Queenstown as tourism centres.

The Sabre database (Sabre AirVision Market Intelligence) has been used as the source of the air passenger flow data for New Zealand from each of the regions. The air passenger data used in this model is based on the true origins and destinations of air travel, which are different from leg-based¹ (airport departure) data. For example, when a person takes a flight in Kerikeri, then transfers to another flight in Auckland, and finally arrives in Sydney, this is only one air passenger journey based on the true origin and destination (Kerikeri to Sydney), but two airport departures (one domestic departure in Kerikeri and one international departure in Auckland).

2. Where do I find the model results?

This is an Excel spreadsheet model, with all scenarios being modelled in a single workbook. Summary results for all regions can be found in the sheet named “Projection Summary”. Total international air passengers from individual regions for specific years are given in columns B to S from row 4 to row 54. The corresponding compound annual growth rates are given in columns B to S from row 60 to row 107. Column T in this sheet is for national total (All regions). These results come from the model calculations in the worksheet called “Working”.

International air passengers include New Zealand residents and overseas visitors leaving New Zealand. The model projects them separately, with the modelling results shown in the “Working” sheet. International departures by New Zealand residents are given in columns B to T from row 94 to row 146 (these are adjusted projections – see section 4 for more details). International departures by overseas visitors are given in columns V to AN from row 33 to row 89.

3. What are the inputs to this model and where do they come from?

A key input to this model is projections of international departures by New Zealand residents at a national level. The Ministry of Transport has had a model to produce these projections for some years. However, that model only had a projection time horizon to the year 2030. Therefore, for the Transport Outlook project, we have extended it to 2043 and produced projections of international

¹ A leg is defined as a non-stop flight.

departures by New Zealand residents at the national level in the following two Excel spreadsheet files, available at [www.transport.govt.nz/transport outlook](http://www.transport.govt.nz/transport-outlook):

- **Air pax departures forecast model_Extended projection for Transport Outlook-Basecase+ScenarioA&B** – this file is for the Base Case, Staying Close to the Action, and Metro-Connected scenarios.
- **Air pax departures forecast model_Extended projection for Transport Outlook-ScenarioC&D** – this file is for Golden Triangle and @Home in Town and Country scenarios.

Column M in the “Projection Summary” worksheet of the above two files shows projected total international departures at the national level by New Zealand residents. Projections of real GDP, population, exchange rate, and CPI for international air travel are needed to generate these passenger projections. The appendix to this document has more information about how to produce the extended projections.

The above projection results for international departures by New Zealand residents need to be linked to the “Input” sheet of this International Air Travel Forecasting Model (columns C to G from row 9 to row 14).

Another key input to this model is projections of international departures by overseas visitors at a national level. The Ministry of Business, Innovation and Employment (MBIE) has a tourism forecasting programme (www.mbie.govt.nz/info-services/sectors-industries/tourism/tourism-research-data/international-tourism-forecasts) which provides these projections. The latest forecasts at the time of model development were for the 2017 - 2023 period. We have extended MBIE’s forecasts to 2043 by making reasonable assumptions for the different scenarios. These projections are shown in the “Tourism” sheet of the separately documented ‘Population and GDP’ file for each scenario to be modelled.

MBIE’s forecasts and the extended forecasts are shown in the “Pax data” sheet of this model (columns B to P from row 36 to row 62) and linked to the “Input” worksheet (columns J to O from row 9 to row 14).

A final key input to this model is population projections for each region and, for the two regions that have been split, for the assumed catchment areas of their four airports (Tauranga, Rotorua, Queenstown, and Dunedin). These are shown for the different scenarios in the “Popu_Region” worksheet of this model (columns C to T).

Regional population projections typically come from the “Population” sheet of the separately documented ‘Population and GDP’ file for each scenario to be modelled. In general, Stats NZ’s population projections are used. Population projections for the catchment areas of the Tauranga, Rotorua, Queenstown, and Dunedin airports are calculated directly from Stats NZ projections of territorial authority populations in the “Popu_District_Projection” sheet.

4. How does this model derive its results?

The Sabre database contains historical data on total international departures from each region based on the true origin of each passenger, D_r , where r represents a region.

The Stats NZ international travel and migration database gives historic data on the number of international departures by New Zealand residents (D_{nz}) and international departures by overseas visitors (D_{ov}) at the national level. The fraction of New Zealand resident departures in total international departures for a specific year can then be worked out as:

$$F_{nz} = D_{nz} / (D_{nz} + D_{ov})$$

Applying this fraction to each region, the number of international departures by New Zealand residents ($D_{r,nz}$) and by overseas visitors ($D_{r,ov}$) from each region can be estimated as:

$$D_{r,nz} = D_r * F_{nz} \text{ and } D_{r,ov} = D_r - D_{r,nz}$$

However, we believe that the situation at Queenstown airport is significantly different from others, with the vast majority of its international departures being overseas visitors. Therefore, we work out the proportion of New Zealand resident departures separately for Queenstown airport. The modelling process can be found in the "Pax_data" worksheet (columns U to Y from row 2 to row 24).

We assume that the growth rate in international departures by New Zealand residents per capita ($D_CAPITAnz$) is the same in all regions. Therefore, the international departures by New Zealand residents from each region in a future year ($D_{r,NZ, \text{future year}}$) can be estimated as:

$$D_{r,NZ, \text{future year}} = D_CAPITAr,nz, \text{base year} * (D_CAPITAnz, \text{future year} / D_CAPITAnz, \text{base year}) \\ * POPULATIONr, \text{future year}$$

In the last six years for which data is available (2010 - 2015), the growth rate in international departures by New Zealand residents per capita is actually not the same in all regions. However, we cannot see a clear trend for many regions. Even for those regions with a seemingly apparent trend, it is not possible to say, based on current data/evidence, what the growth rate will be in the future. For example, the declining trend seen for Rotorua and Waikato is likely caused by the gradual phase out of international air services at the Rotorua and Hamilton airports. This trend may not continue into the future. An exception is Queenstown, where we can see a strong growth in New Zealand resident departures per capita in recent years. Moreover, quite a number of New Zealand residents who do not normally live in the region may have departed from the Queenstown airport. Therefore, its growth rate in departures by New Zealand residents is likely to be higher than the national average and we have, accordingly, made a small adjustment for Queenstown airport.

Finally, we adjust the projections of international departures by New Zealand residents for individual regions/airports so that the national total for a scenario will be the same as the assumed national departures by New Zealand residents from the Ministry's national-level models, discussed in Section 3.

To project international departures by overseas visitors, we have assumed that all of the short-term overseas visitors will leave New Zealand shortly after their arrival; therefore, the growth rate of international departures by overseas visitors for a year will be the same as that for their arrivals. This growth rate will be applied equally to each region. International departures by overseas visitors from each region can, therefore, be estimated as:

$$D_{r, ov, \text{future year}} = D_{r, ov, \text{base year}} * (D_{ov, \text{future year}} / D_{ov, \text{base year}})$$

The proportion of overseas visitors departing from each region/airport in total international departures by overseas visitors varied over time for some regions/airports. The typical examples are an increasing trend for Queenstown airport and a declining trend for Canterbury (partly due to the Christchurch earthquake) and Dunedin airport. Therefore, we have made small adjustments for this. Although a declining trend can be clearly seen for Waikato and Rotorua, their proportion was already very low. We would expect any further reduction in their proportion to be fairly limited in the future.

The number of international departures by overseas visitors from New Zealand based on their true origins and destinations from the Sabre database is significantly lower than the leg-based international departures recorded by Stats NZ. This is due to the different definition for the two types of data sets. For example, an overseas visitor may start his/her journey in Suva, have a short visit to Auckland (less than 24 hours), and then go to Sydney. He/she will be counted in the Stats NZ international departures (as he/she goes through immigration/customs control at Auckland airport), but will be excluded from the origin and destination-based international departures as he/she is considered a transit passenger who does not start his/her journey in New Zealand.

Appendix: Econometric Model for Projecting International Departures by New Zealand Residents

For some years, the Ministry of Transport has had an econometric model to project international departures by New Zealand residents; it is an error correction model based on annual data. The key explanatory variables include real GDP per capita, CPI for international air travel, and a dummy variable (the SARS epidemic event). The model produces projections for the Base Case, low-growth, and high-growth scenarios. The projections in the low-growth scenario have been used as they match historical experience better than in the Base Case.

However, the original econometric model only had a projection time horizon up to 2030. We have extended it to 2043 and produced projections of international departures by New Zealand residents at the national level in the following two spreadsheet files, available at

[www.transport.govt.nz/transport outlook](http://www.transport.govt.nz/transport-outlook) :

- **Air pax departures forecast model_Extended projection for Transport Outlook-Basecase+ScenarioA&B** – this file is for the Base Case, Staying Close to the Action, and Metro-Connected scenarios.
- **Air pax departures forecast model_Extended projection for Transport Outlook-ScenarioC&D** – this file is for the Golden Triangle and @Home in Town and Country scenarios.

In the “Inputs” worksheet of these two spreadsheet files, input the projected exchange rate of the New Zealand dollar to Australian dollar into column J, annual growth rate in real GDP for New Zealand into column K, and annual growth rate of CPI for New Zealand’s international air travel (the CPI for air travel is adjusted by general CPI) into column O. Finally, input the population projection into the “Working” sheet (column J from row 71 to row 100).

The model will first run the ordinary least square equation (Model 2a in the “Methodology” sheet). It will then run the error correction equation (Model 2 in the “Methodology” sheet). All calculations are carried out in the “Working” sheet.