New Zealand Transport Outlook

Leg-Based Air Passenger Model

November 2017

Short name

Leg-Based Air Passenger Model

Purpose of the model

The Transport Outlook Leg-Based Air Passenger Model projects domestic air passenger departures from each of the regions in New Zealand and international departures from the five international airports for the years 2018, 2023, 2028, 2033, 2038, and 2043.

Software used

Excel

For questions and comments:

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Transport Outlook Leg-Based Air Passenger Model

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

The Transport Outlook Leg-Based Air Passenger Model projects domestic air passenger departures from each of the regions in New Zealand and international departures from the five New Zealand international airports for the years 2018, 2023, 2028, 2033, 2038, and 2043. The projections are made 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.

A key source of data is the Sabre database (Sabre AirVision Market Intelligence) that has been used to obtain air passenger departure data for each New Zealand region and the four airports. As discussed in Section 4, the data covers domestic air passengers on seven types of leg[1] and international air passengers on four types of leg. The air passenger data used in this model is based on legs of air travel (airport departures) that are different from those based on true passenger origins and destinations. For example, when a passenger takes a flight from Kerikeri, then transfers to another flight in Auckland, and finally arrives in Sydney, there is only one international air passenger departure, from Kerikeri to Sydney, for this journey based on the passenger's origin and destination. However, there are two airport departures (one domestic departure in Kerikeri and one international departure in Auckland).

The modelling results have been adjusted against the data from several New Zealand sources (see section 3).

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 worksheet named "Projection Summary". Projected domestic air passenger departures from individual regions for specific years are given in columns B to AQ from row 5 to row 24. The corresponding compound annual growth rates are given in the same columns from row 27 to row 46.

Projected international air passenger departures from the five New Zealand international airports (Auckland, Wellington, Christchurch, Queenstown, and Dunedin) are given in columns B to AQ from row 52 to row 61. The corresponding compound annual growth rates are given in the same columns from row 64 to row 73. There is a large number of international transit passengers for Auckland airport. We believe that the drivers for their demand are different from other international passengers. Therefore, we project transit passengers separately. Consequently, there are two sets of projections for Auckland airport and the national total: one includes transit passengers and the other excludes them. The modelling results for domestic passengers come from the "Modelling_Domestic" worksheet and those for international passengers from the "Modelling_Intl" sheet.

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

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

Input to this model is fairly simple. One set of required input data are the modelling results (for all scenarios) of the separately documented Origin and Destination Based Domestic Air Passenger Model. The domestic air passenger projections for individual regions or airports should be linked into the "Modelling_Domestic" worksheet (columns F to AN from row 9 to row 26). Another set of required input data are the modelling results (for all scenarios) of the Origin and Destination-Based International Air Passenger Model. The international air passenger projections for individual regions or airports should be linked into the "Modelling_Intl" worksheet (columns D to AN from row 9 to row 26).

We have adjusted the modelling results to align with historical passenger data for New Zealand airports (see the "Data_Airports" worksheet), national total domestic air passenger data from the Civil Aviation Authority (CAA), and international air passenger departure data from Stats NZ (see the "Data_Sabre_CAA_SNZ" worksheet).

4. How does this model derive its results?

The previously referenced Origin and Destination-Based Domestic Air Passenger Model and Origin and Destination-Based International Air Passenger Model project origin and destination-based air passenger departures from each region of New Zealand. However, leg-based airport departure projections are often needed for planning by airports and central government agencies. This model derives projections of **leg-based** domestic and international departures from these origin and destination-based projections.

A domestic leg is a non-stop flight with both a New Zealand leg origin and a New Zealand leg destination. An international leg is a non-stop flight with a New Zealand leg origin, but an overseas leg destination. The Sabre database classifies passenger legs into four types based on how the passenger uses them: **Local, Behind, Beyond, and Bridge**. A **Local** leg is the only leg a passenger uses for his/her journey. A **Behind** leg is the leg that finishes the passenger's journey and is behind one or more other legs. A **Beyond** leg is the leg on which a passenger starts his/her journey, with one or more additional legs required to complete the journey. A **Bridge** leg is a leg between other legs.

The number of origin and destination-based air passenger departures is different from leg-based departures (airport departures). The difference is explained below using Wellington Airport as an example (see Figures 1 and 2).
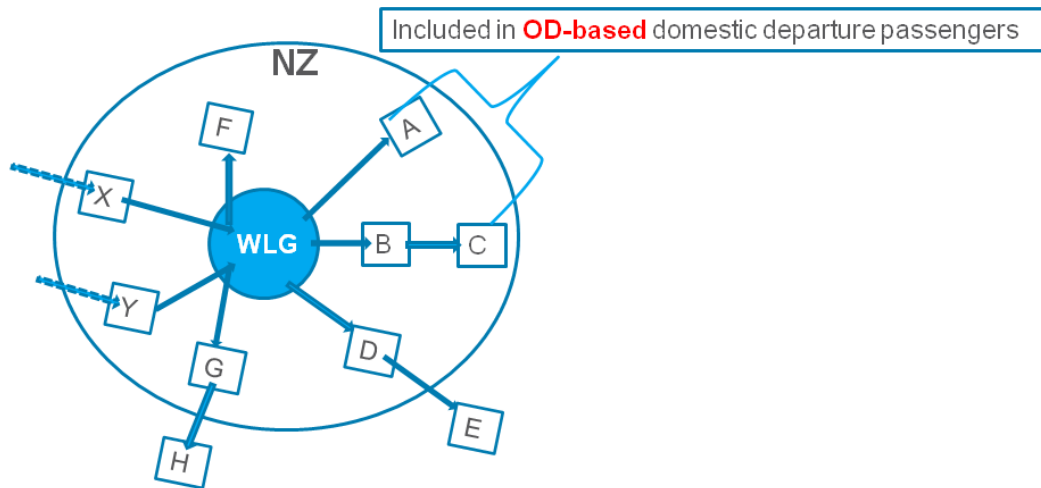
Figure 1: Domestic departures from Wellington Airport, leg-based vs origin and destination- (O&D) based
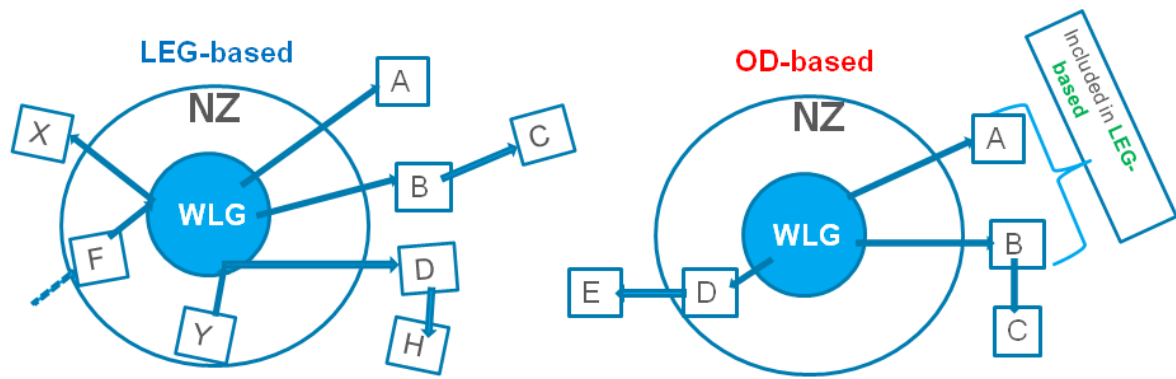
EQUATION 1:
O&D-based domestic departure passengers
   = passengers with a domestic journey destination departing on Local legs
   + passengers with a domestic journey destination departing on Beyond legs.

However, as illustrated in the chart above, many other passengers of Beyond, Behind, and Bridge legs use domestic flights departing from Wellington Airport. Therefore:

EQUATION 2:
Total leg-based domestic departure passengers (domestic airport departures)
   = passengers of ALL domestic departure legs from Wellington Airport
   = O&D-based domestic departure passengers
   + passengers with an international journey destination departing on Beyond legs with a domestic intermediate destination
   + passengers with a domestic journey origin and a domestic journey destination on Behind legs
   + passengers with an international journey origin and a domestic journey destination on Behind legs
   + passengers with an domestic journey origin and a domestic journey destination on Bridge legs (presumably with a domestic intermediate destination)
   + passengers with an international journey origin and/or an international journey destination on Bridge legs with a domestic intermediate destination

Figure 2: International departures from Wellington Airport, leg-based vs O&D-based

EQUATION 3:

O&D-based *international departure passengers*

   = *passengers of* **Local** *legs with an international destination*

   + *passengers with an international journey destination on* **Beyond** *legs with an international intermediate destination*

   + *passengers with an international journey destination on* **Beyond** *legs with an intermediate domestic destination*

However, as shown in the chart above, the passengers on the Beyond legs with an intermediate domestic destination should be counted as domestic departures in terms of airport departures. Furthermore, other passengers on Behind and Bridge legs use international flights departing from Wellington Airport. Therefore:

EQUATION 4:

Total **leg-based** *international departure passengers (international airport departures)*

   = *ALL four types of international departure legs from Wellington Airport*

   = **O&D-based** *international departure passengers*

   - *passengers with an international journey destination on* **Beyond** *legs with an intermediate domestic destination*

   + *passengers on all* **Behind** *legs with an international destination*

   + *passengers on* **Bridge** *legs with an international intermediate destination (and thus, presumably, an international journey destination)*

In our projection, we assume that the growth rate of domestic or international passengers with journeys truly originating from the region will be the same as that of O&D-based domestic or international departures for the region. For all other legs connecting through the region, we assume the growth rate will be the same as that of overall national O&D based domestic or international departures.

The number of transit passengers in Auckland has been relatively stable in the last five years. They are quite different from other passengers. We simply assume a 20% increase in transit passengers by 2043 for the Base Case, Staying Close to the Action, and Metro-Connected scenarios, but a 30% increase for the Golden Triangle and @Home in Town and Country scenarios due to stronger growth in overseas visitors.

Since 2016, international air services are no longer available at Rotorua Airport. Therefore, we assume that international air passenger departures from Rotorua Airport will be routed through Auckland in the future.

The "Modelling_Domestic" worksheet shows the modelling process for projecting domestic air passenger departures. We have used domestic air passenger departure data from New Zealand airports and the CAA in the last three years (2013 to 2015) to adjust our projections.

The "Modelling_Intl" worksheet shows the modelling process for projecting international air passenger departures. We have used international air passenger departure data from Stats NZ in the last three years (2013 to 2015) to adjust our projections.