

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

Short name

Regional Air Travel Forecasting Model

Purpose of the model

The Transport Outlook Origin and Destination-Based Domestic Air Passenger Model projects New Zealand region-to-region domestic air passenger flows for the years 2018, 2023, 2028, 2033, 2038, and 2043.

Software used

Excel

For questions and comments:

transportoutlook@transport.govt.nz

Transport Outlook Origin and Destination-Based Domestic Air Passenger Model

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

The Transport Outlook Origin and Destination-Based Domestic Air Passenger Model projects New Zealand region-to-region domestic air passenger flows for the years 2018, 2023, 2028, 2033, 2038, and 2043. The projections are based on certain assumptions, including New Zealand population and GDP by region 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 the 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. The air passenger data used in this model is based on the true origins and destinations of air travel, which are different from leg¹-based (airport departure) data. For example, when a person takes a flight in Kerikeri, then transfers to another flight in Auckland, and finally arrives in Wellington, this is only one air passenger journey, based on the true origin and destination, but two airport departures (one in Kerikeri and the other in Auckland).

This model was developed by Professor Tim Hazledine from the University of Auckland. Technical details can be found in the report prepared by Professor Hazledine entitled “Projections of regional air passenger flows in New Zealand 2018-2043” available on the Ministry website.

2. Where do I find the model results?

This is an Excel spreadsheet model that was developed based on the original econometric model (see the Appendix). Each Transport Outlook scenario has a separate workbook, except for the Base Case and the Staying Close to the Action scenario. In these two cases, the assumptions are the same for the input variables and they consequently have the same modelling results, so there is one combined workbook for these two scenarios. Summary results for all regions can be found in the worksheet named “TABLES”. The preliminary modelling results for individual regions are given in columns B to J, with the results for Tauranga, Rotorua, Queenstown, and Dunedin in columns S to AA from row 37 to row 113. These results come from the modelling process in relevant worksheets called, for example, “STACKED 2018” etc. The results show projected domestic air passengers from one region to each of the other regions for a specific year. Columns K to P show overall growth in the projected passengers over the indicated time period.

We have found that the Sabre database has systematically overestimated domestic air passengers in New Zealand. Furthermore, small passenger numbers on some provincial routes have been removed during the model development. Adjustment of the modelling results is, therefore, necessary. We have worked out an adjustment factor of 0.97 by comparing the original Sabre data used in model development with data from Civil Aviation Authority and individual airports. Technical details for the adjustment process can be found in a spreadsheet file named “Sabre air pax flow data investigation_20160923” available at www.transport.govt.nz/transport-outlook. In the

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

“TABLES” worksheet, adjusted modelling results for individual regions can be found in columns AK to AS, with those for Tauranga, Rotorua, Queenstown, and Dunedin in columns BD to BL. These adjusted results should be used in all applications and interpretation.

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

The original econometric model uses the following explanatory variables:

- Real GDP (both origin and destination)
- Population (both origin and destination)
- Number of overseas visitor arrivals
- Distance between airports
- Domestic real airfares
- Variables for the quality of air services (for example, number of non-stop flights)

Historically in New Zealand, real domestic airfares have fluctuated and have not shown a clear trend. We also do not have a good idea about how they will develop in the future. Moreover, it is very difficult to project the number of non-stop flights on specific routes over the next 30 years. Therefore, the inputs to this model in our projections at this stage are only real GDP (both origin and destination), population (both origin and destination), and number of overseas visitors, with the other variables implicitly assumed to remain at their 2015 values.

In the “EXOGENOUS FORECASTS” worksheet, the user should input projected national real GDP into cells from F31 to L31, projected national total population into cells from F32 to L32, and projected total overseas visitor arrivals into cells from F36 to L36. The user should input projected regional populations into the matrix defined by the columns AB to AH and rows 6 to 27. These exogenous data cells are highlighted in green.

Exogenous assumptions used in this model for national GDP, overseas visitors, and national and regional populations are typically linked to the relevant worksheets (named “GDP”, “Population”, and “Tourism”) in the ‘Population and GDP’ file for each scenario to be modelled. See the separate documentation about this file. In general, Stats NZ’s population projections, Treasury’s GDP projections, and MBIE’s tourist projections are used in this model, although some modifications and extensions are made to these projections.

4. How does this model derive its results?

Quarterly air passenger data at the airport-to-airport level from quarter 3 of 2009 through to quarter 2 of 2015 were used to develop the original econometric model. The coefficients for explanatory variables in Equation 2 in Table 2 of the report by Professor Hazledine (see the Appendix) were used to estimate growth in air passengers for each airport-to-airport combination for future years. The calculations are performed in the worksheets called STACKED YYYY, where YYYY is the year of the projection.

Firstly, the model works out weighted population² for the likely catchment area of each airport from quarterly population estimates. Together with regional GDP per capita for both origin and

² The best econometric results were yielded by weighting each rural resident at just 0.25 of each urban resident.

destination airport, distance between the airports, and overseas visitor arrivals, the model then estimates quarterly air passengers for the airport-to-airport combination. Finally, the model aggregates airport- to-airport-level quarterly passengers into region-to-region total passengers for the base year (2015).

A region may have two airports (for example, Wellington and Paraparaumu airports in the Wellington region). Therefore, there may be as many as four airport-to-airport combinations providing air services between two regions. Note also that the model only takes into account the significant effect of overseas visitors on four tourism destinations, namely Queenstown, Rotorua, Kerikeri, and Taupo.

To project air passengers in future years, the model first projects airport-to-airport quarterly air passengers based on the growth in population, GDP per capita, and overseas visitor arrivals. It then aggregates these projections into annual passengers for each region-to-region combination. The model assumes that regional GDP/person would grow at the same rate as the national GDP/person.

Appendix: Transport Outlook Origin and Destination Based Domestic Air Passenger Model – Econometric Model

Professor Tim Hazledine from the University of Auckland has developed a gravity-type econometric model using quarterly air passenger data at the airport-to-airport level. Technical details can be found in the report prepared by Hazledine entitled “Projections of regional air passenger flows in New Zealand 2018-2043” available on the Transport Outlook website ([www.transport.govt.nz/transport outlook](http://www.transport.govt.nz/transport-outlook)). The spreadsheet model discussed in the main body of this document is developed based on Equation 2 in Table 2 of this report, as shown below.

	1		2		3		4	
	dependent = LOG(PAX)				dependent = NNONSTOP		dependent=LOG(FARENZ/CPI)	
	coefficient	t-statistic	coefficient	t-statistic	coefficient	t-statistic	coefficient	t-statistic
C	-22.862	-15.43	-30.728	-54.94	-44.101	-26.05	-1.949	-271.43
DATE	0.017	20.13	-0.004	-4.03			0.011	54.75
LOG(WPOPLARGE)	0.576	77.90	0.846	125.03	1.031	52.95		
LOG(WPOPSMALL)	0.472	68.88	0.671	104.41	0.763	38.79		
LOG(GDPPOPD*GDPPPOPO)	0.626	23.51	0.936	35.40	1.186	14.89		
DISTANCE	0.002472	19.89	0.00096	8.29	0.000726	2.22	0.001	40.15
DISTANCE-squared	-1.73E-06	-19.49	-1.63E-06	-18.74	-2.15E-06	-8.33	0.000	-20.31
LOG(VISITORS)*ZQN	0.069	33.36	0.092	45.07	0.089	14.34		
LOG(VISITORS)*ROT	0.021	10.41	0.021	10.44				
LOG(VISITORS)*KKE	0.031	14.44	0.058	27.02	0.103	16.23		
LOG(VISITORS)*TUO	0.020	8.89	0.020	8.93				
SWITCHBACK	-0.602	-31.21	-0.737	-38.95			0.072	20.21
FERRY	0.114	6.29	0.114	6.23				
LOG(FARENZ/CPI)	-1.879	-39.85						
LOG(RFARENZ/CPI)			-1.879	-39.67				
NNONSTOP	0.196	56.35					-0.035	-67.67
RNNONSTOP			0.261	83.58				
R-squared	0.8555		0.8555		0.4102		0.6381	
adjusted R-squared	0.8553		0.8553		0.4099		0.6379	

Notes:

WPOPLARGE = weighted population for the larger airport of the route (city pair)

WPOPSMALL = weighted population for the smaller airport of the route (city pair)

GDPPOPD = real GDP per capita of the region, where the destination of the route is

GDPPPOPO = real GDP per capita of the region, where the origin of the route is

DISTANCE = the distance between the origin and destination of the route

VISITORS = overseas visitor arrivals

SWITHBACK = a dummy variable taking the values 0 or 1, for the routes are “switchbacks” involving a trip in one direction followed by another coming back more than 180 degrees in the opposite direction. An example is Napier-Gisborne, which must be flown via Auckland or Wellington

FERRY = a dummy variable for the routes with end-points on different islands, and so requiring a Wellington-Picton ferry journey across Cook Strait, if undertaken by car, bus or train

FARENZ = airfares in NZ dollars

RFAENZ = residue for FARENZ

NNONSTOP = number of non-stop daily flights on a route

RNNONSTOP = residue for NNONSTOP