

**New Zealand Transport Outlook: Future State**  
**Transport Outlook Road Freight Tonne-Km Model**  
**November 2017**

**Short name**

Road Freight Tonne-Km Model

**Purpose of the model**

The Road Freight Tonne-Km Model projects total New Zealand road freight flows on the roads of each region in billions of tonne-kilometres for the years 2012/13, 2022/23, 2032/33, and 2042/43.

**Software used**

Excel

**For questions and comments:**

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## **New Zealand Transport Outlook: Future State**

### **Road Freight Tonne-Km Model Documentation**

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

The Transport Outlook Road Freight Tonne-Km Model projects total New Zealand road freight flows on the roads of each region in billions of tonne-kilometres for the years 2012/13, 2022/23, 2032/33, and 2042/43. Each road freight tonne handled may incur tonne-kilometres in several regions. For example, a tonne from Christchurch to Invercargill would incur tonne-kilometres on the roads of the Canterbury, Otago, and Southland regions. This model aggregates projected road tonne-kilometres in each region across all tonnes handled.

The model is heavily based on projections from the separately documented New Zealand Transport Outlook Freight Model that provides projections of region-to-region freight flows in millions of tonnes for 19 commodity groups, by various transport modes, including road, rail, and coastal shipping.

There are 14 regions in the model, with the Tasman, Nelson, and Marlborough regions treated as a single region, labelled 'TNM'.

#### **2. Where do I find the model results?**

The model consists of a single Excel workbook for each scenario to be modelled. The table in the upper left corner (C6:G21) of the second sheet in the workbook, labelled 'Results', summarises total projected tonne-kilometres by region of the road where the tonne-kilometres are incurred. Results for each of four modelled years are provided under coloured headings: 2012/13 is shown in red in column D; 2022/23 is shown in yellow in column E; 2032/33 is shown in green in column F; and 2042/43 is shown in blue in column G. These heading colours are used consistently with the given years throughout the model.

There are also projection sheets for individual regions, with tabs identified by the name of each region. The tables on rows 29-44 of these tabs show total tonne-kilometres on the roads of that region broken out by the region-to-region lane incurring the tonne-kilometres. For example, in the 'Manawatu' sheet, cell I38 shows the 2012/13 tonne-kilometres on the roads of Manawatu incurred by freight from Wellington to Hawke's Bay.

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

As noted above, the most important inputs are from the Freight Model, which provides projections of region-to-region freight flows, in millions of tonnes, by road, rail, and coastal shipping for 2012/13, 2022/23, 2032/33 and 2042/43. These results are reproduced in rows 52-67 of the 'Results' sheet.

For each region, there is also a table showing the assumed tonne-kilometres incurred on the roads of the region by one tonne moving on the indicated region-to-region lane or, equivalently, the distance a tonne moving on the indicated region-to-region lane would move within the region. These tables appear in cells C6:Q20 of each of the sheet for each region. For example, cell I15 of the

'Manawatu' sheet shows that a tonne moving from Wellington to Hawke's Bay would incur 145 tonne-kilometres in the Manawatu region, ie a tonne moving from Wellington to Hawke's Bay would move 145 kilometres over roads in the Manawatu region.

For freight that does not originate or terminate in the region, the distances are calculated by first selecting the most likely routing for road movements between the two regions, then measuring the distance between the nearest town to where that route would enter the region and the nearest town to where that route would leave the region. The assumed routings are shown in the 'Routings' sheet, which shows the assumed origin of the freight, the assumed towns nearest to each regional border crossed, and the assumed destination of the freight. For example, cell I15 of the 'Routings' sheet shows that the assumed routing from Wellington to Hawke's Bay would be Wellington-Manakau-Takapau-Napier (it is actually shown in the reverse order, but this does not affect the distances) where Manakau is the nearest town to where the route enters the Manawatu region from the Wellington region and Takapau is the nearest town to where the route enters the Hawke's Bay region from the Manawatu region. The assumed distance moved by this freight in the Manawatu region is, therefore, the distance from Manakau to Takapau. These distances are found in the 'Distances' sheet. Cell R28 of this sheet shows that this distance from Manakau to Takapau is 145 kilometres. In this example, although the shortest route from Wellington to Hawke's Bay is via the Wairarapa, trucks prefer the routing via the Manawatu region as it is relatively flat.

For freight that originates or terminates in a region, the distance within the region is based on the distance from an assumed hub town in the region to/from the town on the assumed route nearest the regional border. In all cases, the hub town is the largest city in the region (or, in the case of Hawke's Bay, we have used Napier as it is the port city). For example, the distance incurred in the Wellington region by freight moving from Wellington to Hawke's Bay is the distance from the Wellington CBD to Manakau, which cell AA28 of the 'Distances' sheet shows to be 81 kilometres. This distance is repeated in cell I15 of the 'Wellington' sheet.

Distances between towns/cities in the regions were calculated using the Automobile Association distance calculator: [www.aatravel.co.nz/main/time-distance-calculator.php](http://www.aatravel.co.nz/main/time-distance-calculator.php).

Assumed routings and nearest towns to regional boundaries were identified primarily from the maps on the website of Local Government New Zealand: [www.lgnz.co.nz/home/nzs-local-government/new-zealands-councils/](http://www.lgnz.co.nz/home/nzs-local-government/new-zealands-councils/).

For freight that originates and terminates in the same region, distances were obtained by dividing the intra-regional tonne-kilometres from the National Freight Demand Study by the intra-regional tonnes from the National Freight Demand Study to obtain an average distance for each intra-regional tonne. For example, cell K14 of the 'Manawatu' sheet shows that the assumed distance incurred on the roads of Manawatu for a Manawatu to Manawatu tonne would be 40 kilometres.

#### **4. How does this model derive its results?**

The calculation proceeds in two stages. First, the tonne-kilometres incurred in each region by freight on each 'lane' (an origin region-destination region combination) are calculated by multiplying the tonnes on the lane by the distance incurred on the roads of each region. These results are shown in the tables in rows 29-44 of each regional sheet. For example, cell I38 of the 'Manawatu' sheet

shows that freight from Wellington to Hawke's Bay incurred a total of 0.017 billion tonne-kilometres in the Manawatu region, which is obtained by multiplying 0.117 million tonnes moving from Wellington to Hawke's Bay by 145 kilometres and dividing by 1000.

Second, these tonne-kilometres incurred in each region are then summed across all region-to-region lanes to obtain the total tonne-kilometres incurred in each region. These totals are shown for 2012/13 in cell R44, for 2022/23 in cell AJ44, for 2032/33 in cell BB44, and for 2042/43 in cell BT44. These same results are then summarised in the 'Results' sheet, cells C6:G21.

The 'Results' sheet also shows the total tonne-kilometres incurred by freight moving on each region-to-region lane in all regions. These are shown in rows 29-44 of the 'Results' sheet. For example, cell I38 of the 'Results' sheet shows that freight from Wellington to Hawke's Bay incurred a total of 0.037 billion tonne-kilometres. By evaluating the formula in this cell, we can see that this consists of roughly 0.010 billion tonne-kilometres on the roads of the Hawke's Bay region, 0.017 billion tonne-kilometres on the roads of the Manawatu region, and 0.009 billion tonne-kilometres on the roads of the Wellington region, which rounds to 0.037 billion tonne-kilometres.