

New Zealand Transport Outlook: Future State

Coastal Shipping Tonne-KM Model

April 2019

Short name

Coastal Shipping Tonne-KM Model

Purpose of the model

The Coastal Shipping Tonne-KM Model projects total coastal freight flows between ports in New Zealand in billions of tonne-kilometres for the years 2012/13, 2022/23, 2032/33, 2042/43, and 2052/53.

Software used

Excel

For questions and comments:

transportoutlook@transport.govt.nz

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Coastal Shipping Tonne-KM Model Documentation

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

The Coastal Shipping Tonne-KM Model projects total coastal freight tonne-kms between ports in New Zealand in billions of tonne-kilometres for the years 2012/13, 2022/23, 2032/33, 2042/43, and 2052/53.

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 road, rail, and coastal shipping.

2. Where do I find the model results?

The model consists of a single Excel workbook for each scenario to be modelled. The workbooks are similar in format to the Road Freight Tonne-KM by Region model and the Rail Freight Tonne-KM by Region model. Those models separately calculate the tonne-kms incurred on the roads or rail lines of each region. However, for coastal shipping, it is not meaningful to calculate tonne-kms incurred on the waters of each region. Therefore, for purposes of calculating coastal shipping tonne-kms by region, New Zealand is regarded as a single region, and some parts of the workbook are not used.

The table in the upper left corner (C6:H21) of the first sheet in the workbook, labelled 'Results', summarises total projected coastal shipping tonne-kilometres on row 21. Because the model does not calculate tonne-kms by region, the rows of the table for each region are marked 'NA'. Results for each of five 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; 2042/43 is shown in blue in column G; and 2052/53 is shown in yellow in column H. These heading colours are used consistently with the given years throughout the model.

There is also a projection sheet called 'New Zealand' showing results for the single all-New Zealand region. The table on rows 29-44 of this tab shows total tonne-kilometres incurred between origin and destination region. For example, cell E41 shows the 2012/13 tonne-kilometres incurred by coastal freight from Canterbury to Auckland.

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 for coastal shipping are reproduced in rows 52-67 of the 'Results' sheet.

In the 'New Zealand' sheet there is also a table showing the assumed tonne-kilometres incurred by one tonne moving on the indicated region-to-region lane, which is the same as the distance between the regions. This table appears in cells C6:Q20 of the 'New Zealand' sheet. For example, cell E18 of this sheet shows that a tonne moving from Canterbury to Auckland would incur 1250 tonne-kilometres between these regions.

Distances between regions are based on port-to-port distances provided by the New Zealand Nautical Almanac (2017-2018)¹. The distances given are in nautical miles, which we converted to kilometres, and are based on tracks usually followed by ships. Each region is assumed to be served by a single port, which is always the largest port in the region. This is an approximation, as some regions have more than one port served by coastal shipping.

4. How does this model derive its results?

The calculation proceeds in two stages. First, the tonne-kilometres incurred on each region to region 'lane' are calculated by multiplying the tonnes on the lane by the distance between the regions. These results are shown in rows 29-44 of 'New Zealand' sheet. For example, cell E41 shows that freight from Canterbury to Auckland incurred a total of 0.050 billion tonne-kilometres in 2012/13, which is obtained by multiplying 0.040 million tonnes moving from Canterbury to Auckland by 1250 kilometres, the distance from the Port of Auckland to the Port of Lyttelton, and dividing by 1000.

Second, the tonne-kilometres are then summed across all region-to-region lanes to obtain the total tonne-kilometres for New Zealand. These totals are shown in the 'New Zealand' sheet for 2012/13 in cell R44, for 2022/23 in cell AJ44, for 2032/33 in cell BB44, for 2042/43 in cell BT44, and 2052/53 in cell CL44. These same results are then summarised in the 'Results' sheet, row 21.

The model estimates total coastal shipping freight in 2012/13 as 3.675 billion tonne-kilometres. This compares to the National Freight Demand Study (NFDS) estimate of 3.6 billion tonne-kilometres² for calendar year 2012.

¹ <https://www.linz.govt.nz/sea/nautical-information/new-zealand-nautical-almanac-nz-204/nautical-almanac-extracts>

² See <https://www.transport.govt.nz/assets/Uploads/Research/Documents/e8dbdbc206/National-Freight-Demand-Study-Mar-2014.pdf>, Table 1.