**Basic PlanIt Test Cases**

1. *Input File Formats*

Each test case has an XML input file called macroscopicinput.xml which contains its input data in the standard XML format (using the <macroscopicdemand>, <macroscopicnetwork> and <macroscopiczoning> elements.

1. *Storing Expected Results and Comparing Test Run Outputs to them*

Expected results are stored in ResultDto objects. A ResultDto object is populated by its constructor call, which has the following arguments:

* startNodeId external id of start node (used to define the link segment);
* endNodeId external id of end node (used to define the link segment);
* linkFlow flow through link (output);
* linkCost cost (travel time) of link (output);
* totalCostToEndNode cumulative travel time from start of output path to the end of the current link (output);
* capacity capacity of the link (input);
* length length of the link (input);
* speed travel speed of the link (input).

Note that a ResultDto object always identifies a link segments by the external ID values of its start and end nodes.

ResultDto objects are populated with expected results from previous runs, whose results match either hand-calculated analysis or corresponding test cases in OmniTRANS.

ResultDto objects are stored in a Java Map whose keys are run id, time period and mode. Test cases may have more than one run, time period or mode so this allows all the results to be stored for each.

The results of the tests runs are stored in MemoryOutputFormatter objects. The TestHelper class contains a method compareResultsToMemoryOutputFormatter which loops through all the ResultDto objects in the map and uses the JUnit assertEquals() method to compare them to the corresponding values in the MemoryOutputFormatter. If the value of a test run output does not match its expected value the unit test fails.

The fifth argument in the ResultDto constructor, total cost to end node, is not currently used. This was originally included to provide a sort order for the ResultDto objects in the Map which stores them. This is quite helpful for human inspection of output files (such as CSV output files) but it not required for tests against the contents of a MemoryOutputFormatter.

1. *Basic Test Cases*

The XML files for test cases 1, 2 and 3 are saved in the src/test/resources/basic directory.

Test cases 1, 2 and 3 all use the network used by Michiel Bliemer in course ITLS6102 (taken from page 120 of the “Introduction, data, key concepts” course notes). This is defined as follows:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| StartNode | EndNode | Direction | Length | NoLanes | Type |
| 1 | 2 | 3 | 33 | 1 | 1 |
| 2 | 3 | 3 | 23 | 1 | 1 |
| 3 | 4 | 3 | 10 | 1 | 1 |
| 4 | 5 | 3 | 10 | 1 | 1 |
| 1 | 6 | 3 | 10 | 1 | 1 |
| 2 | 7 | 3 | 7 | 1 | 1 |
| 3 | 8 | 3 | 8 | 1 | 1 |
| 4 | 9 | 3 | 4 | 1 | 1 |
| 5 | 10 | 3 | 10 | 1 | 1 |
| 6 | 7 | 3 | 31 | 1 | 1 |
| 7 | 8 | 3 | 12 | 1 | 1 |
| 8 | 9 | 3 | 20 | 1 | 1 |
| 9 | 10 | 3 | 20 | 1 | 1 |
| 6 | 11 | 3 | 12 | 1 | 1 |
| 7 | 12 | 3 | 5 | 1 | 1 |
| 8 | 13 | 3 | 40 | 1 | 1 |
| 9 | 14 | 3 | 10 | 1 | 1 |
| 10 | 15 | 3 | 3 | 1 | 1 |
| 11 | 12 | 3 | 8 | 1 | 1 |
| 12 | 13 | 3 | 47 | 1 | 1 |
| 13 | 14 | 3 | 5 | 1 | 1 |
| 14 | 15 | 3 | 10 | 1 | 1 |
| 11 | 16 | 3 | 40 | 1 | 1 |
| 12 | 17 | 3 | 10 | 1 | 1 |
| 13 | 18 | 3 | 15 | 1 | 1 |
| 14 | 19 | 3 | 40 | 1 | 1 |
| 15 | 20 | 3 | 21 | 1 | 1 |
| 16 | 17 | 3 | 12 | 1 | 1 |
| 17 | 18 | 3 | 32 | 1 | 1 |
| 18 | 19 | 3 | 30 | 1 | 1 |
| 19 | 20 | 3 | 9 | 1 | 1 |
| 16 | 21 | 3 | 10 | 1 | 1 |
| 17 | 22 | 3 | 30 | 1 | 1 |
| 18 | 23 | 3 | 20 | 1 | 1 |
| 19 | 24 | 3 | 6 | 1 | 1 |
| 20 | 25 | 3 | 43 | 1 | 1 |
| 21 | 22 | 3 | 5 | 1 | 1 |
| 22 | 23 | 3 | 20 | 1 | 1 |
| 23 | 24 | 3 | 20 | 1 | 1 |
| 24 | 25 | 3 | 40 | 1 | 1 |

Each test case has its own zone definition:

Test 1:

|  |  |
| --- | --- |
| Zone | Node |
| 1 | 1 |
| 2 | 10 |
|  |  |

Test 2:

|  |  |
| --- | --- |
| Zone | Node |
| 1 | 1 |
| 2 | 13 |
|  |  |

Test 3:

|  |  |
| --- | --- |
| Zone | Node |
| 1 | 1 |
| 2 | 20 |

The definitions of route type and demand are the same for all three test cases and are trivial:

Route Types:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Type | Name | Speed | Capacity | Alpha | Beta |
| 1 | Standard | 1 | 2000 | 0 | 0 |

Demand:

|  |  |  |
| --- | --- | --- |
| Origin | Destination | Demand |
| 1 | 2 | 1 |

All the test cases were run with the following parameters for the Stop Criterion:

Epsilon = 0.001

Max Iterations = 5000

For the three basic test cases, the Run Id, Time Period Id, Mode Id, alpha and beta are all zero. The other results are:

Test 1 (A to B in the network diagram):

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Start Node Id | End Node Id | Link Flow | Capacity | Length | Speed | Link Cost | Cost to End Node |
| 3 | 4 | 1 | 2000 | 10 | 1 | 10 | 10 |
| 4 | 5 | 1 | 2000 | 10 | 1 | 10 | 20 |
| 1 | 6 | 1 | 2000 | 10 | 1 | 10 | 30 |
| 8 | 3 | 1 | 2000 | 8 | 1 | 8 | 38 |
| 5 | 10 | 1 | 2000 | 10 | 1 | 10 | 48 |
| 7 | 8 | 1 | 2000 | 12 | 1 | 12 | 60 |
| 6 | 11 | 1 | 2000 | 12 | 1 | 12 | 72 |
| 12 | 7 | 1 | 2000 | 5 | 1 | 5 | 77 |
| 11 | 12 | 1 | 2000 | 8 | 1 | 8 | 85 |
|  |  |  |  |  |  |  |  |

Test 2 (A to C in the diagram):

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Start Node Id | End Node Id | Link Flow | Capacity | Length | Speed | Link Cost | Cost to End Node |
| 1 | 6 | 1 | 2000 | 10 | 1 | 10 | 10 |
| 6 | 11 | 1 | 2000 | 12 | 1 | 12 | 22 |
| 11 | 12 | 1 | 2000 | 8 | 1 | 8 | 30 |
| 12 | 13 | 1 | 2000 | 47 | 1 | 47 | 77 |

Test 3 (A to D in the diagram):

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Start Node Id | End Node Id | Link Flow | Capacity | Length | Speed | Link Cost | Cost to End Node |
| 1 | 6 | 1 | 2000 | 10 | 1 | 10 | 10 |
| 7 | 8 | 1 | 2000 | 12 | 1 | 12 | 22 |
| 8 | 9 | 1 | 2000 | 20 | 1 | 20 | 42 |
| 6 | 11 | 1 | 2000 | 12 | 1 | 12 | 54 |
| 12 | 7 | 1 | 2000 | 5 | 1 | 5 | 59 |
| 9 | 14 | 1 | 2000 | 10 | 1 | 10 | 69 |
| 11 | 12 | 1 | 2000 | 8 | 1 | 8 | 77 |
| 14 | 15 | 1 | 2000 | 10 | 1 | 10 | 87 |
| 15 | 20 | 1 | 2000 | 21 | 1 | 21 | 108 |

All these results can be verified by inspection of the original question.

There is also a hybrid test case which runs all of the three previous test cases in different time periods.

1. *Route Choice Test Cases*

The XML files for the more advanced test cases based on the OmniTRANS examples are saved in the src/test/resources/route\_choice directory.

All these test cases have zero values for Run Id, Mode Id and Time Period Id. They were run with 500 iterations to convergence and a zero epsilon value.

Test Case 1 Network:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| StartNode | EndNode | Direction | Length | NoLanes | Type |
| 2 | 1 | 1 | 1 | 1 | 1 |
| 1 | 3 | 1 | 1 | 1 | 2 |
| 3 | 2 | 1 | 1 | 1 | 1 |
| 13 | 4 | 1 | 1 | 10 | 1 |
| 4 | 2 | 1 | 1 | 1 | 1 |
| 6 | 3 | 1 | 1 | 1 | 1 |
| 12 | 6 | 1 | 1 | 10 | 1 |
| 15 | 5 | 1 | 1 | 10 | 1 |
| 5 | 1 | 1 | 1 | 1 | 1 |
| 2 | 11 | 1 | 1 | 1 | 1 |
| 3 | 14 | 1 | 1 | 1 | 1 |
| 1 | 16 | 1 | 1 | 1 | 1 |

Test Case 1 Route Types:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Type | Name | Speed | Capacity | Alpha | Beta |
| 1 | Standard | 100 | 2000 | 0.5 | 4 |
| 2 | Link 2 | 100 | 1000 | 0.5 | 4 |

Test Case 1 Zones:

|  |  |
| --- | --- |
| Zone | Node |
| 1 | 11 |
| 2 | 12 |
| 3 | 13 |
| 4 | 14 |
| 5 | 15 |
| 6 | 16 |

Test Case 1 Demands:

|  |  |  |
| --- | --- | --- |
| Origin | Destination | Demand |
| 3 | 4 | 1000 |
| 5 | 1 | 1000 |
| 2 | 6 | 1000 |

The results for this Test Case 1 were:

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Start Node Id | End Node Id | Link Flow | Capacity | Length | Speed | Link Cost | Cost to End Node | alpha | beta |
| 2 | 1 | 2000 | 2000 | 1 | 100 | 0.015 | 30 | 0.5 | 4 |
| 1 | 3 | 2000 | 1000 | 1 | 100 | 0.09 | 210 | 0.5 | 4 |
| 3 | 2 | 2000 | 2000 | 1 | 100 | 0.015 | 240 | 0.5 | 4 |
| 13 | 4 | 1000 | 20000 | 1 | 100 | 0.01 | 250 | 0.5 | 4 |
| 4 | 2 | 1000 | 2000 | 1 | 100 | 0.010313 | 260.3125 | 0.5 | 4 |
| 6 | 3 | 1000 | 2000 | 1 | 100 | 0.010313 | 270.625 | 0.5 | 4 |
| 12 | 6 | 1000 | 20000 | 1 | 100 | 0.01 | 280.6251 | 0.5 | 4 |
| 15 | 5 | 1000 | 20000 | 1 | 100 | 0.01 | 290.6251 | 0.5 | 4 |
| 5 | 1 | 1000 | 2000 | 1 | 100 | 0.010313 | 300.9376 | 0.5 | 4 |
| 2 | 11 | 1000 | 2000 | 1 | 100 | 0.010313 | 311.2501 | 0.5 | 4 |
| 3 | 14 | 1000 | 2000 | 1 | 100 | 0.010313 | 321.5626 | 0.5 | 4 |
| 1 | 16 | 1000 | 2000 | 1 | 100 | 0.010313 | 331.8751 | 0.5 | 4 |

Test Case 2 Network:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| StartNode | EndNode | Direction | Length | NoLanes | Type |
| 11 | 1 | 1 | 1 | 3 | 1 |
| 1 | 4 | 1 | 1 | 1 | 1 |
| 4 | 12 | 1 | 1 | 3 | 1 |
| 1 | 2 | 1 | 2 | 1 | 1 |
| 2 | 4 | 1 | 2 | 1 | 1 |
| 1 | 3 | 1 | 1 | 1 | 1 |
| 3 | 4 | 1 | 1 | 1 | 1 |

Test Case 2 Route Types:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Type | Name | Speed | Capacity | Alpha | Beta |
| 1 | Standard | 60 | 1200 | 0.5 | 4 |

Test Case 2 Zones:

|  |  |
| --- | --- |
| Zone | Node |
| 1 | 11 |
| 2 | 12 |

Test Case 2 Demands:

|  |  |  |
| --- | --- | --- |
| Origin | Destination | Demand |
| 1 | 2 | 3600 |

Test Case 2 results:

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Start Node Id | End Node Id | Link Flow | Capacity | Length | Speed | Link Cost | Cost to End Node | alpha | beta |
| 11 | 1 | 3600 | 3600 | 1 | 60 | 0.025 | 90 | 0.5 | 4 |
| 1 | 4 | 1879.2 | 1200 | 1 | 60 | 0.066784 | 215.5 | 0.5 | 4 |
| 4 | 12 | 3600 | 3600 | 1 | 60 | 0.025 | 305.5 | 0.5 | 4 |
| 1 | 2 | 295.2 | 1200 | 2 | 60 | 0.033394 | 315.358 | 0.5 | 4 |
| 2 | 4 | 295.2 | 1200 | 2 | 60 | 0.033394 | 325.2161 | 0.5 | 4 |
| 1 | 3 | 1425.6 | 1200 | 1 | 60 | 0.033266 | 372.6397 | 0.5 | 4 |
| 3 | 4 | 1425.6 | 1200 | 1 | 60 | 0.033266 | 420.0634 | 0.5 | 4 |

Test Case 3 Network:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| StartNode | EndNode | Direction | Length | NoLanes | Type |
| 11 | 1 | 1 | 2 | 4 | 2 |
| 1 | 3 | 1 | 2 | 2 | 1 |
| 1 | 2 | 1 | 2 | 2 | 3 |
| 2 | 3 | 1 | 2 | 2 | 2 |
| 3 | 5 | 1 | 2 | 1 | 2 |
| 3 | 4 | 1 | 2 | 2 | 1 |
| 4 | 5 | 1 | 2 | 1 | 2 |
| 5 | 12 | 1 | 2 | 1 | 2 |

Test Case 3 Route Types:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Type | Name | Speed | Capacity | Alpha | Beta |
| 1 | Capacity1500 | 100 | 1500 | 0.5 | 4 |
| 2 | Capacity2000 | 100 | 2000 | 0.5 | 4 |
| 3 | Capacity2500 | 100 | 2500 | 0.5 | 4 |

Test Case 3 Zones:

|  |  |
| --- | --- |
| Zone | Node |
| 1 | 11 |
| 2 | 12 |

Test Case 3 Demands:

|  |  |  |
| --- | --- | --- |
| Origin | Destination | Demand |
| 1 | 2 | 8000 |

Test Case 3 results:

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Start Node Id | End Node Id | Link Flow | Capacity | Length | Speed | Link Cost | Cost to End Node | alpha | beta |
| 11 | 1 | 8000 | 8000 | 2 | 100 | 0.03 | 240 | 0.5 | 4 |
| 1 | 3 | 4048 | 3000 | 2 | 100 | 0.05315 | 455.1492 | 0.5 | 4 |
| 1 | 2 | 3952 | 5000 | 2 | 100 | 0.023903 | 549.6135 | 0.5 | 4 |
| 2 | 3 | 3952 | 4000 | 2 | 100 | 0.029529 | 666.3104 | 0.5 | 4 |
| 3 | 5 | 4144 | 2000 | 2 | 100 | 0.204314 | 1512.989 | 0.5 | 4 |
| 3 | 4 | 3856 | 3000 | 2 | 100 | 0.047294 | 1695.353 | 0.5 | 4 |
| 4 | 5 | 3856 | 2000 | 2 | 100 | 0.158175 | 2305.275 | 0.5 | 4 |
| 5 | 12 | 8000 | 2000 | 2 | 100 | 2.58 | 22945.27 | 0.5 | 4 |