

CHAPTER 9

Map-to-Map Matching Editors in Singapore

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9.1 Basic Information

Entry point to documentation:

<http://matsim.org/extensions> → `networkEditorSingapore`

Invoking the module:

See <http://matsim.org/extensions> → `networkEditorSingapore` for more information

Selected publications:

Ordóñez Medina (2011a)

For the Singapore scenario and supply data, a high resolution network was obtained from the NAVTEQ company. This network consists of a graph representing every road in the island: very convenient for a high resolution model like MATSim. However, the information on travel capacities and network link free speeds is not accurate. To offset, local authorities provided the network model used for planning, which includes only major roads and simplified intersections, but capacities and free speed are accurately estimated. Figure 9.1 shows lower travel capacities of many primary roads in the navigation model (right), than in the planning model (left).

This section describes a semi-automatic tool developed to match these two network models (Ordóñez Medina, 2011a), allowing updating of navigation network (high-res network) main links/capacities and free speeds with those of the planning network (low-res network).

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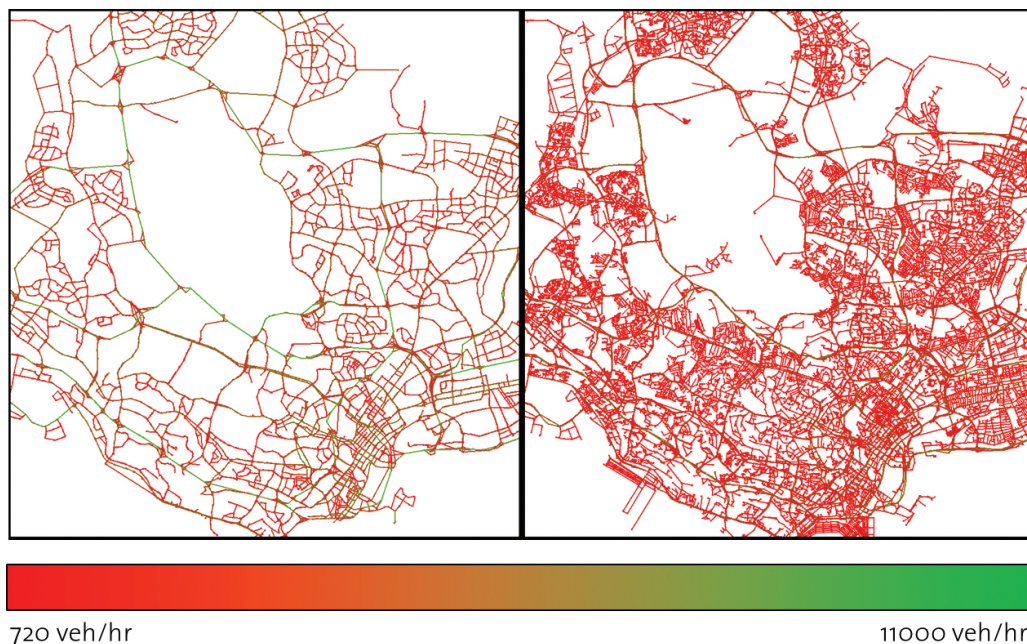


Figure 9.1: Difference in the travel capacities between the Singapore planning network model (left) and a navigation network model (right).

9.1.1 General Procedure

Although many authors try to solve matching problems for two networks in a formal way, this work follows a semi-automatic approach. This means that automatic algorithms will be used to try and solve the problem, but the user knows the solution will not be perfect; some manual work must be done. Hence, interactive tools are also provided to manually improve solutions.

The map-to-map procedure is based on the algorithm developed by Balmer et al. (2005a). It consists of the following steps:

1. Classify nodes according to their topology (e.g., source, sink, one way start, crossing) in both networks.
2. Reduce networks according to previous classification, and save relations to the original nodes.
3. Find crossings (set of close nodes) in both networks and relate them.
4. **Assuming not all crossings were found in the previous step, use the interactive tool shown in the Figure 9.2 to find all crossings in both networks and relate them.**
5. Recognize links or sequences of links joining crossings found in (3) and (4).
6. **Assuming not all links or paths found in the previous step are correct, use the link-link matching interactive tool shown in the Figure 9.3, to find or modify links or sequences of links joining the crossings**
7. Update capacities and free speeds of matched links found in (5) and (6).

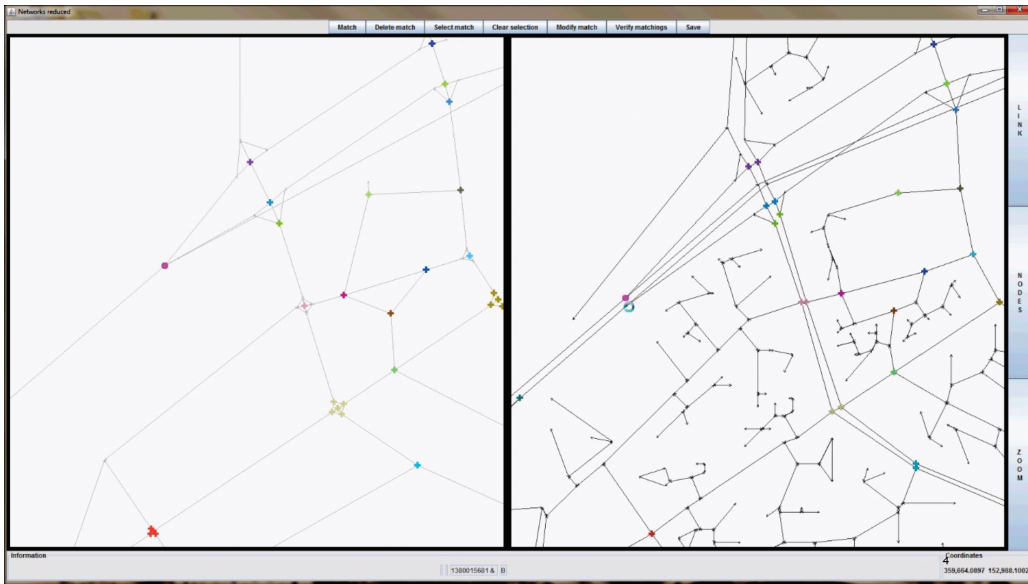


Figure 9.2: Crossing-crossing matching application. A second node, matching the pink node on the (left) low-res network, is selected from the high-res network on the right.

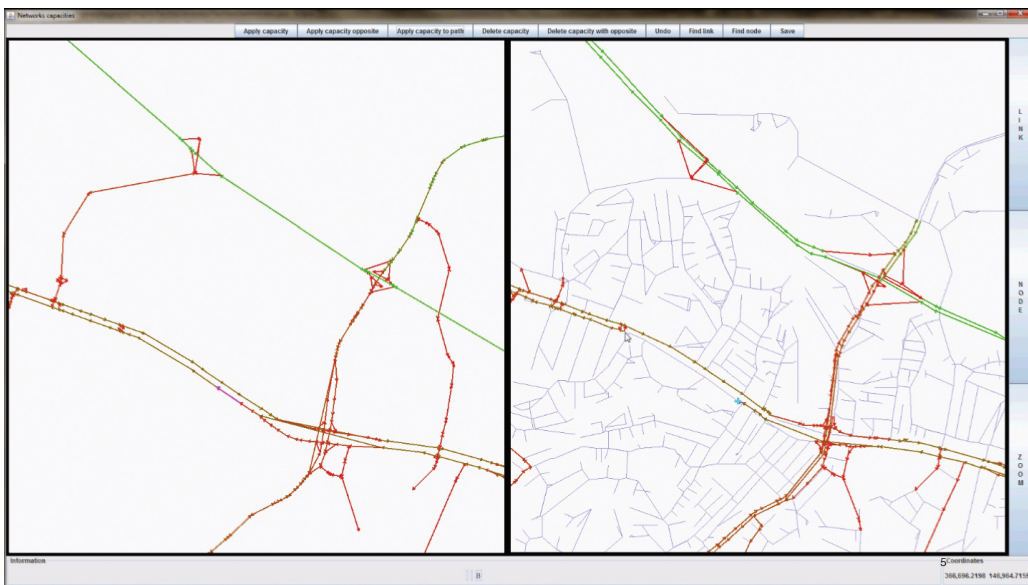


Figure 9.3: Link-link matching application. A shortest path algorithm to select a sequence of right-hand network links will be executed when clicking the destination node.

9.1.2 Interactive Tools Characteristics

As shown in Figure 9.2, the application allows interactive modifying of crossing-crossing relationships. A very similar interactive tool was also developed to modify link-link relationships between the high and low resolution networks. They can be found at the package `playground.sergioo.networksMatcher2012`, in the playgrounds project of MATSim. To run the crossings-crossing application graphic interface, use the class `gui.DoubleNetworkMatchingWindow`, and use the class `gui.DoubleNetworkCapacitiesWindow` for the link-link application. These applications write simple text files of the relationships located. The program found at the class `ApplyCapacities` overwrites capacities and/or free speeds, according to simple text files and writes the new resulting network XML file. This multiple-steps design enables running interactive applications several times, or in parallel. The interactive tools' developed functional requirements and quality attributes are:

- **Visualization:** Two navigation networks are displayed in two modes. The first mode splits the window in two, showing each network on one side and maintaining them at the same geographical position and zoom when navigating. The second superimposes both networks in the same window, with only one active. Selected elements are drawn in different colors. Everything is displayed in a bi-dimensional interactive way, showing the cursor location in the working coordinates and including panning, zoom and view-all options. The crossing-crossing application displays matched sets of nodes (crossings), with the same color in both networks. The link-link application tool also allows visualization of the capacity (or free speed) property value of both networks' links, using a color scale, as shown in Figure 9.3.
- **Selection:** The applications enable selection of links and nodes from both networks. The crossing-crossing option allows only selection of node sets. The link-link application allows selection of links' sequence. This can be done directly, or by selecting an origin node, a destination node and running a "select shortest path algorithm tool". It is also possible to select the other link instead of the first one chosen.
- **Matching and Deletion:** The applications allow creation of a similarity relationship between elements selected in both networks, sets of nodes, or sequences of links.
- **Saving:** The applications allow located relationships to be saved.
- **Loading:** The applications allow the loading of previously located relationships.
- **Others:** The crossing-crossing application executes and automatically verifies currently found matching, to avoid repeated nodes. It also enables clearing of the current selection. The link-link application allows automatic navigation to a link, or node, specified by the user, using its ID. It also enables the undoing of previous matching.

9.1.3 Results

All low-res network links were matched to high-res links, updating the corresponding link properties. Figure 9.4 shows the differences in travel capacities between original navigation network values and the final version. Eight hours of manual work were required to match crossings and ten hours of manual work to match links. Obviously, improvements in accuracy and completeness of the automatic matching algorithms reduce the manual work time.

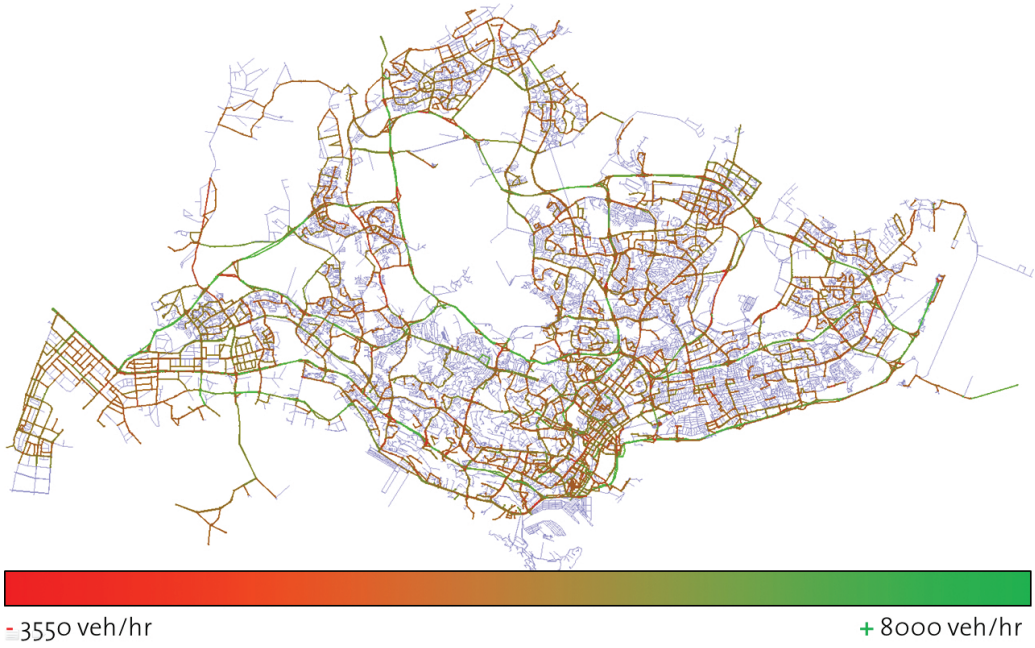


Figure 9.4: Resulting changes in navigation network travel capacity property.

