RESEARCH REPORT 627

Data standards for the New Zealand transport network

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Developing data standards for the transport network

As transport network operations become more time critical, the need for knowledge of the current state of the network and how it is performing, becomes crucial in order to support informed decision making.

Although there is already a significant amount of data and information about the New Zealand transport network being generated by a number of internal and external sources, these sources are all based on independent spatial information about the network itself.

Typically, this spatial information about the network is developed to meet the specific needs of the system using it, leading to diverse representations of the same transport network among different data platforms.

In addition, there is a lack of transport-specific data analysis platforms that are resilient to change, lightweight and cost efficient to maintain. Analytical tools are often tied to specific proprietary systems, and this can compromise their adaptability and makes it difficult to keep up with rapidly changing developments, including transient changes, in the transport network.

A Transport Agency-funded research project, undertaken by the Queensland University of Technology in Australia, has developed a method to support standardised reference models of transport networks. The method will normalise the diverse representations of transport networks presented by various data sources, and support this data being presented in the context of a standardised reference transport network model.

Report author Marc Miska explains the project's purpose, 'This project aimed to develop a specification for a sustainable data model for historical and real-time analysis of transport operations. It was not an effort to build a transport model for the New Zealand transport network and it included no efforts to rebuild or interfere with existing transport models used by the Transport Agency. The focus was to establish guidelines or specifications towards a sustainable, high-quality, software agnostic data standard that informs business process in the mid to long term. The data standard will define the format and meaning of data stored for network operations analysis.'

The current situation

Current network analysis is highly data driven, drawing on the vast amount of measurement data that is available from sensors such as inductive loops, Bluetooth, cameras, OptaSense and traffic control systems.

However, roadside data measurement and control systems tend to provide non-geospatial information. To be able to visualise and analyse the collected data, it is typically mapped into a pre-defined set of nodes and links (representing the transport system), or transferred into a geo-spatial information system (GIS).

This process of mapping the data to a network is the key challenge with network analysis, as there is no single network or source of information about the network that provides the foundation for the various network models used within the Transport Agency and elsewhere.

Once the data has been mapped, the application using the data tends to evolve organically, without any links to other applications and with high maintenance costs, as mapping tables have to be maintained and updated regularly to keep the application functioning.

These costs also prevent longitudinal datasets being collected for network analysis, as the effort involved in maintaining change logs tends to mean that it is only feasible to maintain data about the latest version of the network model. This then

makes it difficult to compare the network's past and present performance.

Marc Miska writes, 'Networks are changing, datasets are changing and requirements for network analysis are changing. Therefore, it is necessary to establish a robust and sustainable process to create network models that adapt over time, are backwards compatible, and can cope with minor changes without disrupting day-to-day business for network analysts.'

Towards a standardised network model

The project initially sought to develop a New Zealand data standard that provided a cost-effective, robust and sustainable solution for transport network analysis. However, after an initial review, it became apparent that data standardisation alone would not provide the required benefits and a more elaborate platform was needed.

The project accordingly shifted focus towards finding a method that would support normalising diverse network representations of selected data sources, and presenting that information within a standardised reference transport network model.

The proposed method developed by the research is based on the idea of using geometry to identify both road network elements and operational transport data.

'The proposed solution leverages the power of GIS to work with geo-spatial relationships without depending on any specific GIS in particular. Instead of using unique identifiers for network elements and data points, the proposed solution stores information against a geometry. This powerful connection allows varying levels of granularity among users without breaking the fundamental relationship between the network and its data,' the report says.

The result is a network model based on existing GIS and sensor data that is resilient to minor changes, cost effective and software agnostic. The model offers several benefits, including:

- small network changes will have no effect on operational analysis
- sensor and other data sources can be added without depending on links, path, or section sizes
- diverse datasets can be added without being constrained
- it will support user queries about the data sets.

These features will allow the reference model itself to adapt over time to increase overall data quality without having an impact on operations.

The research project has shown it is possible to build such a network model, and its foundation and components are described in the research report. In addition, the project developed a web-based demonstrator to showcase the internals of the proposed model.

The recommended next step is to implement a full version of the prototype, using one of the big cloud platforms, such as Google, Amazon or Microsoft Azure. Developing such a platform would help drive 'collaborative innovation in network analysis across authorities and academia,' the report says.