Towards a digital twin for urban transport

This programme of work, funded by the Economic Data Innovation Fund, brings together the Department for Transport (DfT) with partners at three Urban Observatories based at University of Newcastle, University of Birmingham, and University of Manchester to respond to key government objectives.

To create more efficient and effective urban environments, through the collaborative collection and collation of near real time urban data, partners will:

- Regularise data sharing processes between the DfT and the urban observatories;

- Standardise the maturity of data across the urban observatories, identifying and addressing any issues of data quality and quantity; and

- Improve the usability, discoverability and accessibility of data

to strengthen and support pandemic recovery and agendas for levelling up and decarbonisation at national and regional scales.

Partners are ambitious to take the project forward in the longer term. A second stakeholder session is scheduled for late March to update on the future direction of work.

Context

The most recent census data shows that more than 81% of the UK population is now urbanised. As the urban population grows, there is an increased need for operational, standardised real time data to support decision-making to create more efficient and effective cities.

This project emerged from a collaboration between the Department of Transport and the Urban Observatory in Newcastle during the Covid-19 pandemic. Urban Observatories offer a unique service, gathering large amounts of data relating to cities to help develop urban environments for the future and enable informed decision-making to protect the environment as cities grow. Extension of the partnership to include Urban Observatories based in Manchester and Birmingham widens the scope of data available to include information on traffic flow, active travel, micro-mobility, meteorology, and air quality.

On 1st February 2022, partners from the DfT and the Urban Observatories in Newcastle, Birmingham and Manchester met with stakeholders to outline the project through four use cases, and to seek ways of working together to ensure that the project meets its objectives and potential.

Vision

In addition to the short-term objectives outlined above, in the mid- to long-term the project is seeking to link with the National Digital Twin. Scaling up the project requires input from other cities and agencies. With stakeholder support, over time a **blueprint will be developed to outline how a wider network of agencies and cities can get**

involved to create a universal platform for accommodation in the National Digital Twin.

We are seeking to work towards this vision with new and existing stakeholders. Your input can support identification of new use cases, and add depth to those we have

already identified. It will also aid our gap analysis to understand what else needs to be done to achieve our goals.

Collaboration will bring several benefits to the project and its stakeholders:

- Improvements to the quality of existing datasets, improving efficiency and effectiveness;

- Data sharing to meet local and national objectives;

- Cost effective automation of services.

Stakeholder discussion points

- Potential to engage with WAZE. Their route advocacy in avoidance of congestion is indiscriminate in terms of road appropriateness and safety;

- Error margins will be dependent on the quality of measurement and the quality of the data stream. Hard-to-measure factors such as air quality should be treated with caution. Urban Observatories conduct data validation and are considering the use of task-based data and quality labelling to counteract quality issues;

- Consideration of ways in which existing infrastructure can be reused as a data source to capture wider network metrics.

Current use cases

Vision for integrated sensor data: The project is seeking ways to on-board data contributed by different cities and agencies easily. This will allow harmonisation at scale, enabling comparison across cities and regions. A pilot, integrating existing data streams through a third-party platform, maps data onto a common data model for access via an open portal. The addition of different data types would create a homogeneous understanding across urban areas.

Forecasting traffic: To predict traffic volume ahead of time, an accessible toolset was developed connecting disparate data streams. This facilitated responses to issues at local level in Manchester where other models may be less effective. Issues such as sustainability, and usability and accessibility for stakeholders are key to scaling this up to national level. However, computing hardware and stakeholder skillsets are not mutually exclusive: forecasting techniques can run on a range of different platforms, making them accessible across different stakeholder groups.

Low traffic neighbourhoods: Mobilities in low traffic neighbourhoods can be monitored with an open source tool,

which is currently under development at the Alan Turing Institute, Manchester. Collaboration with Urban Observatories will enable the calibration of the model to keep buses and cyclists moving safely. The tool is part of a larger transport planning package which will run anywhere in the UK.

Measurements of black carbon: Because of its short atmospheric lifetime, reductions in black carbon can have an immediate impact on local health outcomes and climate impact. Although Manchester, Newcastle and Birmingham all have traffic intervention neighbourhoods, there is a paucity of black carbon measurement in these areas. MA 350 air thermometers will be installed in all three cities – in doing so, a blueprint for deployment and coordination, and the generation of metadata will be developed to enable better understanding of short- and long-term change.

Potential use cases

- Decarbonising transport, e.g., electric freight linking;

- Multimodal network management;

- Mapping best locations for active travel hubs;

- Passive methods to identify the mode and purpose of a journey to supersede periodic census data;

- Emissions data to bus shelters and transport hubs;

- Clustering of people to inform decisions about the location of transport hubs;

- Contextualising the cost of transport modes;

- The impact of congestion charges on behaviour, capturing intended and unintended consequences across traffic / public transport / active travel modes;

- Multimodal transport network management predicting incident analytics, real-time notifications to allow targeted intervention;

- Comparing classic sensor data to 'reused' data from non-classic sensors;

- Out-of-vehicle trip and travel data.

Next steps

We welcome input from new and existing stakeholders at our next showcase event, planned for late March 2022, when we will outline plans for our emerging blueprint and the future direction of the project.