



NZTA research summary

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# Methods of measuring mode share and mode shift at different spatial scales and timescales

## Measuring people's travel behaviour helps authorities plan and monitor transport policies, infrastructure and other interventions

People, organisations and businesses use many different modes of transport, but the 3 main modes are:

- **Active transport** (walking and cycling).
- **Private transport** (all other private vehicles).
- **Public transport** (bus, rail and ferry).

The proportion (share) of travellers using different modes of transport is 'mode share'. The term 'mode shift' refers to changes in mode share over time. For example, mode shift occurs when people stop using their cars for their daily commute in favour of using the bus or cycling.

Authorities (this includes regional and local councils, and transport authorities) measure people's travel behaviour by collecting data about mode share. Depending on their needs, they collect mode-share data at different spatial scales (from a whole region through to major traffic corridors or individual roads). They calculate mode shift to monitor long-term trends in travel behaviour, and to measure the impact that interventions (such as a new stretch of highway or a bus lane) and transport policy (such as reduced fares on public transport) have on mode share.

## Authorities need detailed information about mode share, to make good decisions

Authorities measure mode share at three main spatial scales:

- **Macroscopic** – the whole country or several regions.
- **Mesoscopic** – strategic locations, such as major roads or key transport corridors.
- **Microscopic** – individual roads or parts of roads ('links').

Mode share also varies significantly by the time of day or night; by day of the week; and by season. It is also influenced by events and incidents (such as road closures and diversions). Therefore, to have a detailed picture of travel behaviour, authorities need mode-share data for different timescales – from periods of less than an hour through to years.

While counting vehicles is one way to collect mode-share data, knowing the actual number of people travelling and the distance they travel gives authorities a more comprehensive view of travel activity. Therefore passenger-kilometres travelled (PKT) is the preferred measure of mode share. For example, PKT counts the number of people travelling on a bus, whereas a vehicle count would only count the bus.

## Traditional ways of measuring mode share and mode shift do not provide authorities with good enough information

Until recently, authorities have relied on household travel surveys (such as the New Zealand Household Travel Survey) and censuses (such as the New Zealand Census of Population and Dwellings) to measure people's travel behaviour and choices and monitor how they are changing.

The surveys provide detailed information about travel habits. However, they capture data from only a small sample of people. This means that authorities need to wait several years before they have enough reliable data

for transport planning and investment purposes, and even longer to get big enough samples from outside major urban areas. Therefore, their insights are of limited use for planning transport outside these areas. Censuses, on the other hand, collect data from nearly the entire population, but are conducted even less often than surveys and gather less detailed information about travel behaviour.

To overcome these problems, authorities in Australia and New Zealand now run household travel surveys more frequently – in some cases they run them continuously. They also incorporate technology into the survey methods (such as giving people GPS trackers as well as paper-based travel diaries) to make surveys more reliable and less costly to run. In other cases, authorities are investing in new, innovative approaches.

## Alternative approaches to measure mode share and mode shift are emerging

Advancing technology means that authorities can now consider using new, innovative ways to capture reliable data on mode share for smaller spatial scales and shorter timescales. There are two main alternatives to surveys:

- **A screenline approach**, which measures people's travel activity by collecting data from sensors at strategic locations (such as highways or routes into a city centre). The sensors are positioned along artificial lines – 'screenlines'. A screenline approach usually measures mode share by counting vehicles.
- **A link-based approach**, which measures people's travel activity by collecting data from sensors on individual roads (links) or estimating mode share on minor roads. A link-based approach can aggregate mode-share measurements and estimates to estimate travel activity – using PKT – for a whole transport network (such as a city centre or region).

Unlike household travel surveys, screenline and link-based approaches are well suited to measuring mode share within smaller areas. Both approaches monitor travel and transport continuously, so authorities can observe trends for different timescales. They can easily view differences between times of day, peak periods and holidays. They can also more easily see the effects of time-based events, such as a new railway line opening, or a road closed for maintenance.

Although some authorities, including in Australia and New Zealand, are trialling these initiatives, there are not yet consistent guidelines for collecting, analysing and reporting their data.

## Emerging technologies and data sources are promising, but need to be combined with conventional approaches to produce comprehensive data

Around the world, including in Australia and New Zealand, authorities are using advanced technologies to continuously measure travel activity from different data sources, and fuse them together to produce high-quality and timely information. This is enabling them to observe mode-share in near-real time and for much smaller geographical areas than ever before. However, the data infrastructure to support these technologies is not yet available everywhere.

The researchers assessed conventional (household travel surveys) and alternative (screenline and link-based approaches) options being used in Australia and New Zealand to find out:

- which transport modes they can measure
- how many people and vehicles they capture data from
- how quickly they respond to changes in mode share (how frequently they measure data)
- how their data is accessed, analysed and processed.

They find that authorities in New Zealand have several promising new technologies and sources of data on vehicle and passenger numbers, transport modes and kilometres travelled by people or vehicles. These include sensors powered by artificial intelligence, smartphone applications and crowdsourced data. However, the researchers find that no single data source can measure all transport modes, at the spatial scales and timescales that authorities need. They conclude that data from conventional and emerging sources need to be fused, to comprehensively measure mode share and mode shift.

## New Zealand authorities are trialling different approaches to measuring mode share and mode shift, but they can still report their data consistently

Several New Zealand authorities have invested in advanced data infrastructure and capabilities and are making significant progress towards monitoring transport activity continuously in their local areas. They require data for different purposes, and they are at different stages of upgrading their data-collection approaches and infrastructure. This means that each authority's available data is not entirely consistent with that of others. As authorities transition towards scaled-up approaches

that continuously monitor mode share, they need guidelines on how to collect, analyse and report their data consistently.

The researchers demonstrate the potential to report mode-share data from different authorities consistently. In a pilot study, they collected and processed data from four New Zealand authorities (Auckland Transport, Greater Wellington Regional Council, Hamilton City Council and Wellington City Council) that are using a screenline or link-based approach to measure mode share. They created a single information 'dashboard' for the processed data. The dashboard allows users to visualise mode-share and mode-shift data and trends for the different authorities at various spatial scales and timescales. It also offers the potential for authorities to compare or benchmark their data with that of other regions.

Through this pilot study, the researchers demonstrate that it is feasible to report mode-share and mode-shift data consistently, even when the data is collected by different authorities using different approaches.

## A toolkit will enable authorities to collect, analyse and report mode-share and mode-shift data consistently

Taking what they learned from assessing current practices and conducting a pilot study, the researchers developed a toolkit that authorities can use to harmonise their approaches to measuring and reporting on mode share and mode shift.

The toolkit helps users decide which approach to collecting mode-share data will best suit their purpose. For example, the approach and data source that authorities use to examine the impact of new transport infrastructure on mode share will be different to the approach and data sources they use to monitor how active-transport behaviour varies in different seasons. The toolkit contains guidelines on how to specify the data requirements for their selected approach, and how to collect, analyse and report on that data, including using data-visualisation techniques.

By establishing a consistent approach to measuring and reporting on mode share and mode shift, the toolkit offers the basis, in future, to aggregate data from authorities across New Zealand. This would provide advanced insights into travel behaviour and activity for the whole country.



RR 733: *Methods of measuring mode share and mode shift at different spatial scales and timescales*. NZ Transport Agency Waka Kotahi research report. Available at [www.nzta.govt.nz/resources/research/reports/733](http://www.nzta.govt.nz/resources/research/reports/733)