NZTA research summary

November 2025

Bridging the gap: measuring and valuing integrated accessibility

Access is about potential interaction opportunities and is among everyday life's most important factors. Despite its critical role in our lives, the analyses of accessibility are incomplete due to various reasons, including lack of data, biased measurement and disconnection with welfare. Various papers construct accessibility measures without considering the usefulness of these measures. The others that focus on the welfare aspect often lack the details on measurement. Almost none of the available studies consider all these aspects together and conclude the value of access.

NZ TRANSPORT AGENCY
WAKA KOTAHI

Te Kāwanatanga o Aotearoa
New Zealand Government

To address this knowledge gap, Principal Economics was contracted by NZTA in 2023 to carry out this research project to:

- review national and international data and methodologies for constructing a multi-dimensional accessibility measure and explain the use of live and static General Transit Feed Specification (GTFS) files to inform spatial accessibility
- use modal reach curves to quantify how far people are willing to travel in different New Zealand contexts to reach different destination types
- develop appropriate weighting for integrating different destination types into measures that account for and represent the 'value' of reaching different destination types for various population groups.

Measuring person accessibility is critical to inform the integration of land use and transport decisions

The common (cumulative) accessibility measures are constructed based on the reach of a destination (typically jobs) within a time or a simple distance measure. This measure is mostly administrative (defined by an analyst and not based on a tested definition of access). It does not consider various dimensions of access that may matter to social welfare.

The danger is using these untested measures for transport planning that may have unintended consequences. Accessibility considers how transportation infrastructure integrates with land use, impacting the ease with which people can reach desired locations.

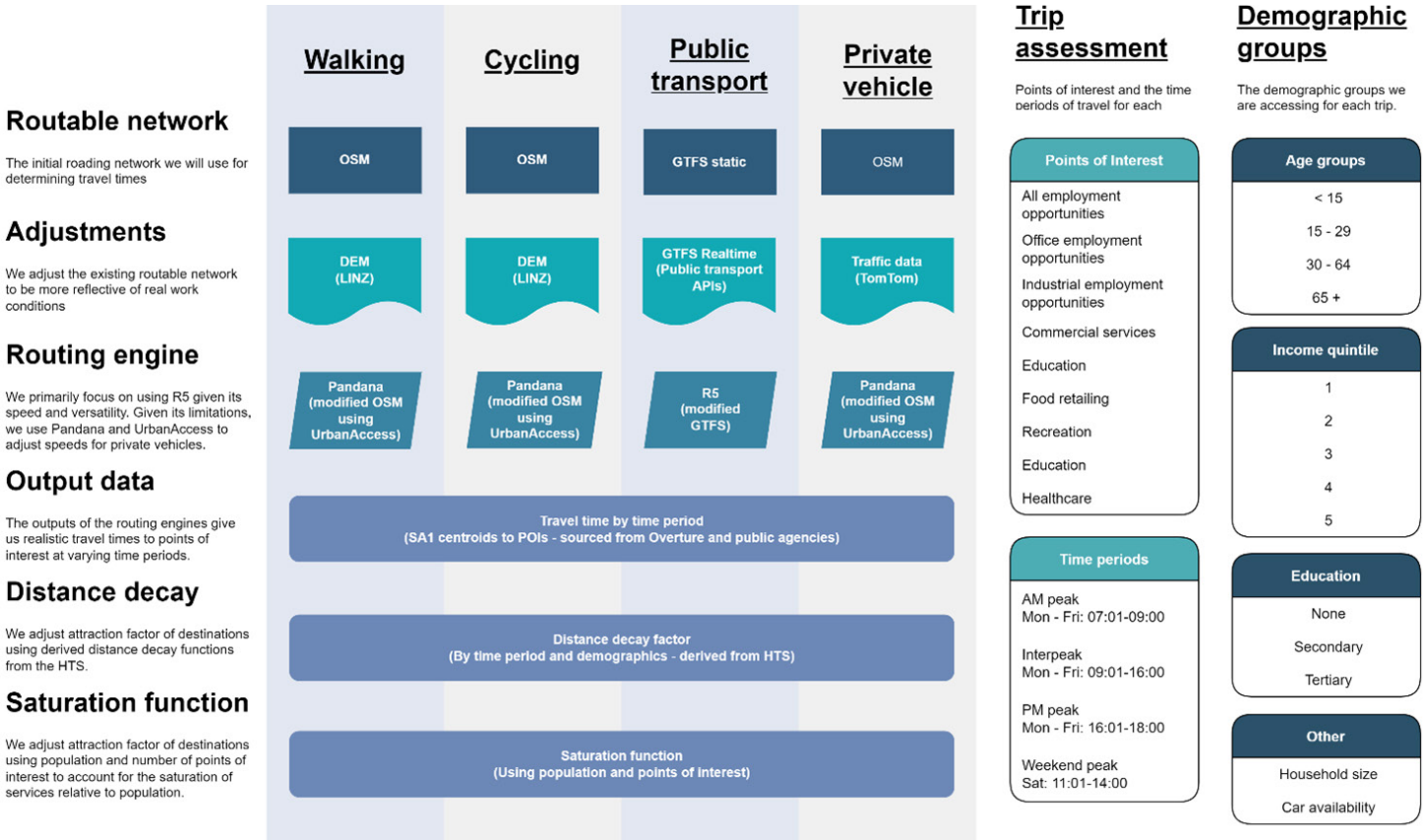
While we identified a range of barriers to the use of accessibility measures, particularly due to lack of data and time-consuming methodologies, the rapid change in the available technologies and the use of multi-dimensional accessibility measures in transport appraisals indicate the importance of considering these measures, identify best methods for their construction and develop robust methods for using them. To enhance this, our research project provides a toolkit for constructing accessibility measures.

Constructing accessibility measures

We constructed over 2,900 measures of access disaggregated by nine travel destinations, four travel times, four travel modes, four age groups and five income quintiles.

As shown in Figure 1, we undertook extensive modelling and data analysis, including estimating 4,800 regressions to obtain decay factors by dimensions of accessibility measures. In addition to the individual accessibility measures, we constructed a range of aggregate measures using principal component analysis (PCA) methodology.

Figure 1: constructing accessibility measures



Using accessibility measures

The measures are useful to illustrate various dimensions of access clearly. For example, this can highlight the best available modes for reaching healthcare during the PM peak period for the median-income working-age population. However, there are too many measures to investigate, and it is unclear if they matter to an effective improvement of access. For example, if private vehicle travel time was improved due to an investment in roads, the measure of access may show that driving access to a destination is higher but there is no information on whether that translates into any benefits to society. It is unclear if driving was the best mode for improving access and if the lack of access (and its improvement) is considered a benefit by population groups at all. Hence, we tested the measures of access against the welfare of individuals and identified the most critical measures of access to Auckland and Wellington communities.

Our estimated value of overall access varies between $14,266 and $46,448

We identified the combination of aggregate accessibility measures correlating with welfare by purpose. Then we estimated willingness to pay (WTP) and willingness to accept (WTA) for these measures. For this, we considered our estimate of the correlation between welfare and income and the best available estimate from international studies. We compared the results with the latest studies available and identified the estimated values using our sensible income parameter. Accordingly, the overall value of access is between $14,266 (WTP) and $46,448 (WTA) per household per annum.

We further disaggregated the value of access for different income quintiles

We first tested the variation in the estimated impact of PCA measures across (adjusted) income quintiles – the lowest quintile (Q1) to the highest quintile (Q5). The results showed that the parameters do not change (Table 1). This is likely due to the endogeneity of access with respect to location choice, which leads to a spatial wellbeing equilibrium. We recommend that a future study explores this further.

Table 1: dollar value of 1% increase in normalised aggregated access measures to different income quintiles – 2023 real prices using New Zealand General Social Survey income impact estimate

Measure (mode, purpose, time)	WTP					WTA				
	Q1	Q2	Q3	Q4	Q5	Q1	Q2	Q3	Q4	Q5
Food	$1,065	$2,111	$3,003	$4,983	$14,585	$1,065	$5,393	$7,671	$12,732	$29,754
School	$359	$712	$1,013	$1,726	$3,929	$1,736	$3,440	$4,893	$8,119	$18,977
Education	$186	$369	$525	$871	$2,036	$1,711	$3,389	$4,821	$8,002	$18,700
Retail	$226	$447	$635	$1,010	$2,463	$1,545	$3,061	$4,353	$7,226	$16,886
All industries	$520	$1,030	$1,465	$2,432	$5,684	$599	$1,187	$1,688	$2,802	$6,548
Health	$291	$575	$828	$1,365	$274	$3,209	$534	$759	$1,259	$2,979
Other	$54	$107	$152	$252	$590	$207	$411	$585	$972	$2,271
Industry	$25	$49	$69	$115	$268	$91	$180	$256	$425	$993
Recreation	$3	$7	0	$10	0	$4	$8	$12	$20	$11
Total	**$2,729**	**$5,407**	**$7,690**	**$12,764**	**$29,829**	**$10,167**	**$17,603**	**$25,038**	**$41,557**	**$97,119**

Suggestions for future research

- The role of accessibility in agglomeration economies, a concept central to economic theory, is not as clearly understood as needed. Agglomeration economies refer to the benefits firms and individuals obtain by locating near each other (in spatial and industrial clusters). We suggest the main reason for the lack of evidence in this space is the underdeveloped accessibility measurement, which is now addressed in this report. We suggest using our identified accessibility measures and further investigating the relationship between access and land values in a future study that also needs to consider the impact of digital accessibility.
- We suggest further research into the impact of reliance on cars on accessibility in New Zealand. While the literature mostly agrees that increased accessibility is associated with less car usage, a few recent articles discuss that reliance on the motor vehicle in US cities mostly leads to greater accessibility compared to the European cities
- Public transport patronage and private vehicle driving were subject to significant changes during and after the COVID-19 pandemic. Since the data used for public transport and driving is live data, the vehicle kilometres travelled and public transport patronage may already have bounced back as is evident from the national data. However, the results may still be affected by the aftermath of COVID-19 if we are not yet back to equilibrium.
- With the increase in work-from-home opportunities and the uptake of various technologies, access has been considered differently by population groups. In a future study, it is critical to further investigate the integration between virtual and physical accessibilities.
- There is a need to collect real-time GTFS for other regions. We collected real-time GTFS for Auckland, Canterbury and Wellington.
- Developing a behavioural survey of walking and cycling to inform logsum analysis and impedance function could improve analysis of cycling and further consider the increased role of ebikes, which flatten out a city so that hilliness is no longer an issue for ebike riders. This will likely have important implications for the distance decay function in our study, which considers slope a negative factor for the likelihood of cycling.
- We used the available information from OpenStreetMap (OSM) and spatial data for walking. Given the broad scope of our report (at the national level), it proved difficult to collect information on other attributes that contribute to walking access such as sidewalk width. While OSM has fields for these attributes, there is no information included in those fields. We suggest that practitioners could calculate and update accessibility measures for smaller, mainly urban areas.
- In our analysis of distance decay, we have not controlled for chained trips. This should be further investigated in the future using the Household Travel Survey dataset.

RR 738: Bridging the gap: measuring and valuing integrated accessibility.
NZ Transport Agency Waka Kotahi research report.
Available at **www.nzta.govt.nz/resources/research/reports/738**