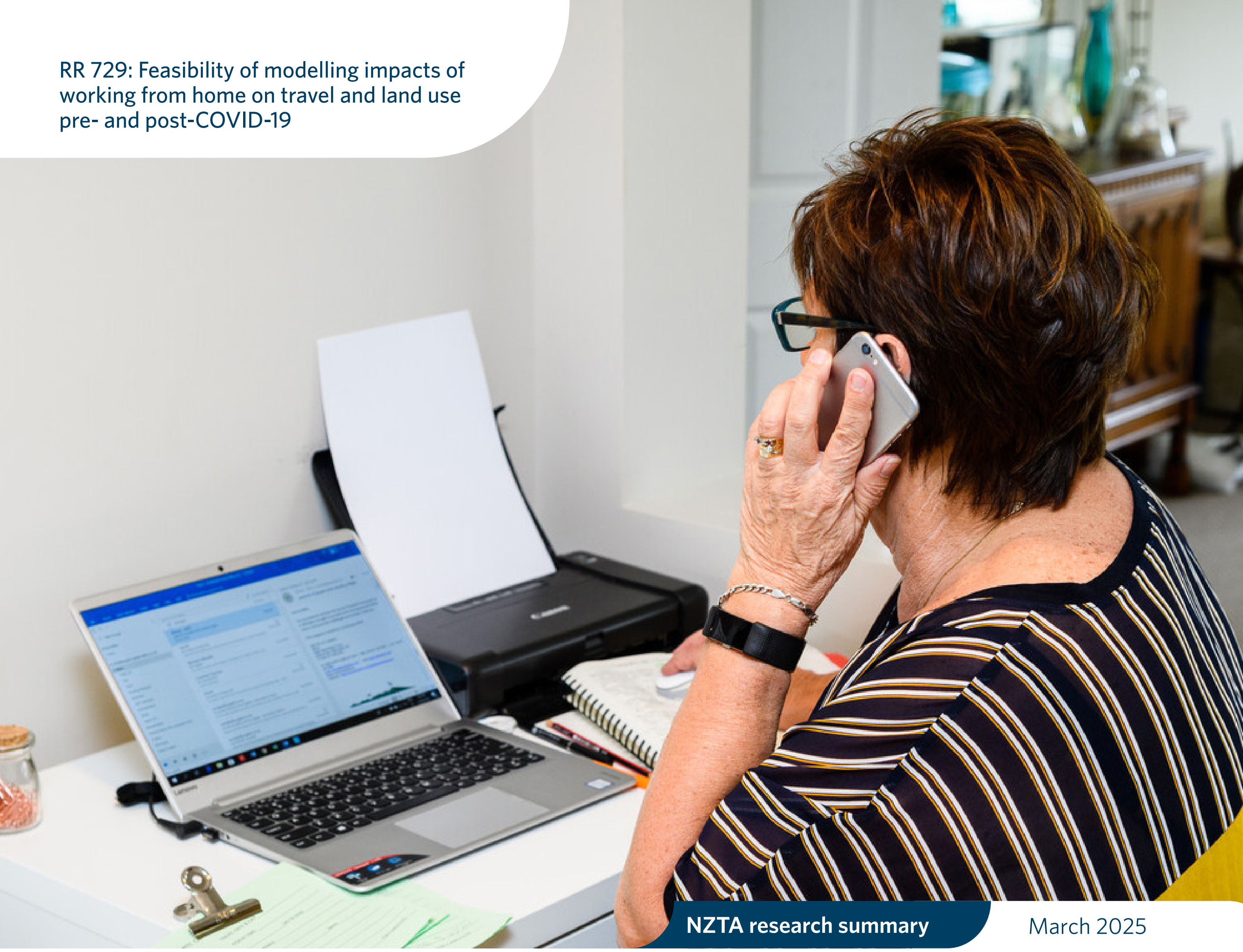
RR 729: Feasibility of modelling impacts of working from home on travel and land use pre- and post-COVID-19



NZTA research summary

March 2025

Feasibility of modelling impacts of working from home on travel and land use pre- and post-COVID-19

The legacy of the COVID-19 pandemic includes the demonstration that some parts of the economy can achieve business as usual without relying on staff attending a centralised workplace. The possibility that many roles can be undertaken from home is now established. Although there has been a steady reduction in working from home (WFH) since the end of lockdowns around the world, data from the US is suggesting a longer-term trend of 28% of workdays WFH.

Although there is not yet equivalent data in New Zealand, the prevalence of WFH is evident through empty seats in the office and observed fluctuations in road and public transport demands. There are also indications of changing living habits, including establishing home offices and the possibility of living further away from the office on the basis of needing to travel less.

NZ TRANSPORT AGENCY WAKA KOTAHI

Te Kāwanatanga o Aotearoa
New Zealand Government

What we did

Literature review of WFH demand variables

A wide-ranging literature review highlighted multiple themes of drivers behind choosing to WFH. These included:

- work and employment factors – the type of role, whether it can be WFH, corporate policy on WFH, the size of company and physical home working environment
- transport and accessibility – length of trip, modes available, quality of access and quality of digital connectivity
- social and demographic – the role of gender, household interactions, psycho-social determinants and the role of perceived social obligation in weighing up whether or not to WFH
- environment and land use – location of workplace, size of city and agglomeration effects
- other drivers such as days of the week.

The information obtained included varying degrees of quantitative analysis, including some with a statistical significance context.

Identifying optimal approaches to modelling and uncertainty management

Strategic models are tools used to assist decision making by testing alternative interventions such as road schemes, pricing mechanisms or land-use outcomes in terms of how much and by what means people would travel. The outputs of these tools are used to inform design and as part of economic evaluation and evidence for investment quality assurance. The inclusion of WFH as a separate model of travel in a strategic model would provide a scientific basis to test impacts on network capacities, emissions and potentially settlement patterns.

Incorporating WFH into a choice framework is challenging. Characteristics of WFH are totally different from other modes of transport. Disruptive influences are transforming the ways people travel and also how they plan their lives and make decisions. COVID-19 and subsequent societal changes, including WFH, have highlighted an increasing need for modelling and appraisal frameworks to adapt in order to reflect these changes and provide better information to decision makers.

Traditional methods were considered alongside newer methods of practice emerging in New Zealand that are better suited to handling more complex travel choice behaviours. Specialised uncertainty management methods were also assessed for their usefulness.

Rationalisation phase

From the literature review, it was possible to determine the more significant variables behind decision making and insights into the volition itself.

Using a team-based cognitive mapping exercise, it was possible to express relationships between the variables. Building on this, an appraisal of the likely statistical behaviours of the variables was considered, directly leading to understanding how each variable would fit into a model framework. For one example, some significant variables were found to be collinear, meaning that they would be ineffective at explaining choice and therefore not an effective independent variable in a model. This processing of variables enabled a shortlist of what choice attributes would represent WFH in a model.

Other key findings included the illusive or qualitative nature of some variables and therefore needing to deploy synthetic valuation methods such as contingency valuation in order to capture into a quantitative framework. Some key variables were considered beyond the capabilities of conventional statistical methods of estimation requiring more bespoke methods, including scenario planning.

It was then possible to begin developing possible model structures for the shortlisted variables by drawing on enquiries into optimal approaches and uncertainty management methods. A hypothetical survey framework was considered that could yield a basis (main effects plan) for estimating the weightings of the variables in a model.

Assessment of methods

Three different model frameworks were developed and overlayed against a high-level assessment framework. Each framework consisted of an initial high-level checking stage, a main model (based on variations of logit) and attached scenario planning tool to manage variables beyond statistical estimation.

Each option was split into two sub-options – one representing use in a conventional model framework and the other representing use in an emerging activity-based modelling (ABM) framework.

The themes of the assessment sought to capture resource requirements (both model build and data), ongoing costs, ease of implementation and use by the industry, consultation with the industry, quality of outcome (effectiveness) and ability to be used in conjunction with other tools and methods.

Further, the method used would need to fit inside a regional model and preferably be compatible with ABM. An architecture was developed to highlight how the preferred method would fit into a larger tool.

Presentation of hypothetical model and discussion

The recommended option is centred around a nested logit, an accessible method capable of managing heterogeneity between variables. It is also a method compatible with both traditional regional model frameworks and emerging ABM. The nested logit method can be used in combination with the use of the initial and scenario planning stages that complements the main tool but can be input discretely, limiting the amount of work required in updates, maintenance and so on.

Our recommendation and conclusions

Our findings have shown that it is feasible to incorporate WFH as a mode into transport models by using a combination of methods. A key finding of the work is that many of the variables are beyond the capabilities of traditional methods to meaningfully capture, and the complementary use of scenario planning or similar is essential. Some of the variables would be more effectively represented in the emerging ABM, and the recommended framework would also be compatible with that method. It was considered that more technically effective methods would be more resource intensive and less available to the industry to put into practice.

Our overall recommendation is to progress the recommended option towards development as an effective tool for capturing the effects of WFH. As a method that can enhance traditional regional modelling tools, this would therefore enable improved opportunities to measure and monetise the impacts of WFH on the transport system and provide a step change in terms of supporting informed decision making.

RR 729: Feasibility of modelling impacts of working from home on travel and land use pre- and post-COVID-19 NZ Transport Agency Waka Kotahi research report.
Available at **www.nzta.govt.nz/resources/research/reports/729**