IN THE HIGH COURT OF NEW ZEALAND **AUCKLAND REGISTRY**	**CIV-2021-404-1618**

I TE KŌTI MATUA O AOTEAROA
TĀMAKI MAKAURAU ROHE

UNDER	the Judicial Review Procedure Act 2016
IN THE MATTER OF	an application for judicial review
BETWEEN	**ALL ABOARD AOTEAROA INCORPORATED** Applicant
AND	**AUCKLAND TRANSPORT** First respondent
AND	**THE REGIONAL TRANSPORT COMMITTEE FOR AUCKLAND** Second respondent

Cont.

AFFIDAVIT OF TODD ALEXANDER LITMAN IN REPLY

22 March 2022

Assigned judicial officer:

Next event date: Hearing on 26-28 April 2022

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AND	**AUCKLAND COUNCIL** Third respondent

AFFIDAVIT OF TODD ALEXANDER LITMAN IN REPLY

I, Todd Alexander Litman, of Victoria, British Columbia, Canada, Planning Consultant, swear –

1. This is the second affidavit I have made in this proceeding. I make it in reply to the affidavit of Hamish Bunn filed on behalf of the respondents.

2. I confirm that I have read and complied with the Code of Conduct for Expert Witnesses in preparing my affidavit.

Summary of my evidence

3. Mr Bunn's affidavit contains many misconceptions and fallacies of a technical nature that do not align with contemporary transport planning understandings. It is therefore necessary for me to respond in some detail to Mr Bunn's evidence.

4. The key points of my evidence can be summarised as follows:

   (a) Transport investment can indeed reduce emissions, and there is no reason to conclude that the RLTP investment programme could not have achieved more.

   (b) Models such as the Macro Strategic Model (**MSM**) on which Mr Bunn relies heavily have systemic biases that mean they underestimate induced vehicle travel, leverage effects and traffic evaporation. They are unsuitable for estimating mode shift and emissions reductions potential of an investment programme such as the RLTP.

   (c) Peer cities offer compelling evidence of how transport investment decisions can lower emissions.

   (d) The effects of roadway supply on vehicle travel and emissions are that roadway expansion increases vehicle travel and emissions, and roadway contraction decreases them.

   (e) Road space reallocation is an accepted way to provide affordable improvements to the sustainability of the transport system, while also delivering positive economic, social and cultural outcomes.

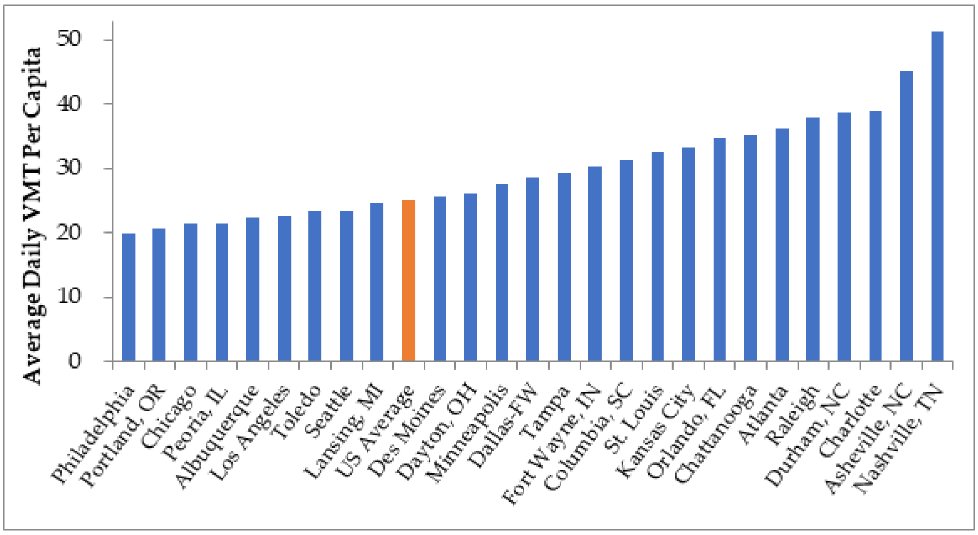
The ability to reduce emissions through transport investments

5. At paragraphs 205-216, and elsewhere in his affidavit, Mr Bunn claims that "there is little ability to further reduce overall emission through RLTP direct investment in infrastructure and services. Fundamentally, investment in infrastructure or services only has a very minor impact on total emissions, whether positive or negative." [[201.0328]]

6. In my opinion, this is untrue, and reflects a combination of biases in the Macro Strategic Model (**MSM**) used by Auckland Transport, and the limited scope of vehicle travel reduction strategies considered.

7. As illustrated in Figure 1 below, there are large variations in per capita vehicle travel and emissions among otherwise similar urban regions, results that can only be explained by their transport and land use policies. For example, residents of Atlanta, Charlotte or Nashville drive about twice as many annual kilometres as residents of Philadelphia, Portland or Chicago. There is no reason to think their travel demands are fundamentally different – they all need to commute to school and work, and to travel for shopping and recreation, and they respond similarly to incentives such as the availability of walking and cycling infrastructure, public transport service quality, road tolls and parking fees.

Figure 1 **Daily vehicle-miles in U.S. urban regions**[1]



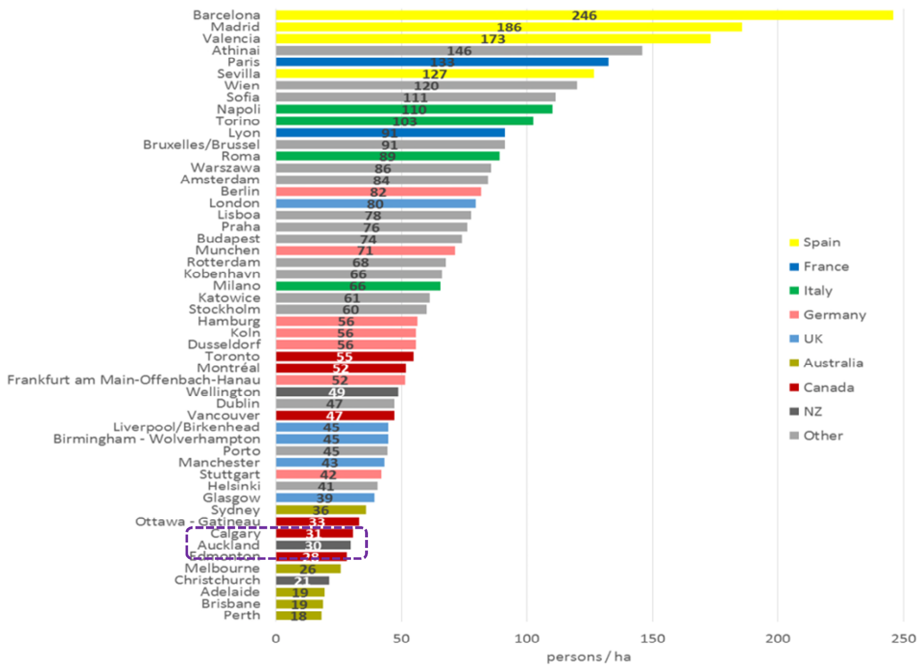
Per capita vehicle travel varies significantly between U.S. urban regions. This is largely explained by differences in transport planning and development policies.

8. These large differences in per capita vehicle travel reflect the large differences in transport planning and development policies. If a city is designed to favour car travel, with abundant road and parking supply, higher traffic speeds, and minimal investment in non-car modes, residents will drive far more than if that community applies more multimodal transport policies.

9. Auckland currently has attributes of both the higher- and lower-mileage cities. It has relatively low densities, as illustrated in Figure 2 below, plus high car ownership rates and a relatively automobile-oriented transport system, like most sprawled U.S. cities.

[1] FHWA (2020), "Urbanized Areas: Selected Characteristics," Highway Statistics, U.S. Federal Highway Administration (www.fhwa.dot.gov); at www.fhwa.dot.gov/policyinformation/statistics/2020/hm72.cfm.

Figure 2 **Population-weighted density**[2]



Auckland has much lower weighted population density than most peer cities, indicating significant potential for infill development that could increase accessibility and reduce automobile travel.

10. However, Auckland is also geographically constrained, has a strong basic public transport network that includes buses, trains and ferries, and many parts have relatively high Walk Score (Figure 3 below). It therefore has the potential for significantly more compact infill development and more multimodal planning that can significantly reduce vehicle travel.

11. Experiences in similar cities, such as Seattle and many European cities, demonstrate that significant vehicle travel reductions are possible through a combination of carrots (improving resource-efficient modes and increasing housing supply in walkable urban neighbourhoods) and sticks (commute trip reduction programmes, efficient road and parking pricing, reduction of space for driving and parking, and urban growth management).[3]

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[2] Chris Loader (2016), *Comparing the Densities of Australian, European, Canadian, and New Zealand Cities,* Charting Transport (https://chartingtransport.com); at https://bit.ly/3MUEIjQ.

[3] OECD (2021), *Transport Strategies for Net-Zero Systems by Design*, OECD, at https://doi.org/10.1787/0a20f779-en. [[312.5037]]

Figure 3 **Auckland walk score heatmap**[4]

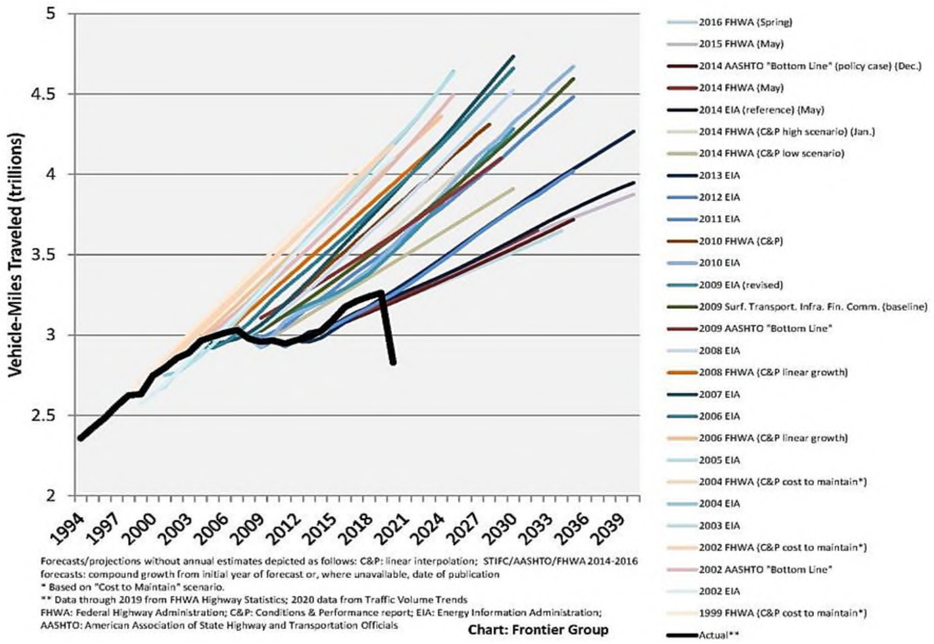
Some Auckland neighbourhoods have high walk scores, as indicated by green. Residents of these areas tend to drive less and rely more on resource-efficient modes. Raising walk scores and increasing infill development in walkable neighbourhoods is an effective way of reducing vehicle travel and emissions.

The accuracy and reliability of the Macro Strategic Model

12. Many of Mr Bunn's arguments (too many to cite individually) are based on the results of his group's modelling using MSM. Such models are notoriously inaccurate, particularly with regard to predicting the long-term effects of new policies. For example, Figure 4 below illustrates the vehicle travel growth predicted by various travel models compared with what actually occurred.

[4] Auckland Walk Score (www.walkscore.com/score/downtown-auckland).

Figure 4 **Projected versus actual vehicle travel**[5]



Virtually all major transport models significantly overestimate vehicle travel growth. In fact, per capita vehicle travel peaked about 2004, due to demographic and economic trends. Many of the factors that contributed to these errors are still applied. As a result, traffic models are likely to exaggerate vehicle travel demand and the benefits of roadway expansions, and underestimate the impacts and benefits of non-car modes and travel demand management incentives.

13. The models that made these erroneous predictions were developed by organisations with significant resources, including the U.S. Federal Highway Administration (FHWA), the U.S. Environmental Protection Agency (EPA), and the American Association of State Highway and Transportation Officials (AASHTO). In almost every case these models *significantly* overestimated traffic growth. These were not random errors: the models all skewed toward overestimation.

14. This occurred because all of these models contained structural biases. They extrapolate past trends without accounting for demographic and economic factors that may affect travel activity. In fact, per capita vehicle travel peaked about the year 2004 and has declined slightly in most developed countries, a phenomenon called "peak car".[6] This is due to demographic and economic trends, including: aging population; improved accessibility alternatives (such as telecommunications and delivery services that substitute for physical travel, and innovations such as e-bikes); and changing consumer preferences that are increasing demand for active and public transport, and for living in a walkable urban neighbourhood. The models also tend to underestimate the price

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[5] Tony Dutzik (2021), *Frontier Group at 25: Transportation for a New Generation*, The Frontier Group (https://frontiergroup.org); at https://bit.ly/37wiN2r.

[6] Phil Goodwin (2012), *Peak Travel, Peak Car and the Future of Mobility*, ITF-OECD; at www.itf-oecd.org/peak-travel-peak-car-and-future-mobility.

elasticity of travel and so failed to account for the effects of 2010 to 2014 fuel price increases.

15. The following are specific technical issues that tend to bias traffic models such as MSM.

Underestimating induced vehicle travel

16. Older transport models, including basic four step models such as MSM, treat travel as an incompressible liquid such as water. From this perspective, planning decisions do not affect the total number of trips and person-kilometres that occurs in a community: these are considered exogenous to the model, and it is assumed that planning decisions and programmes can only affect when, how and by which route people travel. Newer, more sophisticated models include *feedback*. They recognise that travel demands are more like a gas that expands to fill available space, rather than a liquid. In dense urban areas where there are lots of potential travel demands, these effects are large, particularly over the long run (more than four years).

17. Older models often ignore or underestimate the tendency of traffic congestion to limit further growth in vehicle travel and sprawl, and therefore the additional vehicle travel induced by urban highway expansions. This is particularly true of long-term land use development effects.

18. Extensive research indicates that traffic congestion tends to maintain a self-limiting equilibrium: it increases to the point that some potential peak-period vehicle trips are foregone.[7] Most urban residents have probably done this: when congestion is severe you choose closer destinations for shopping and socialising, but when congestion is light you consider driving across town to a better store or to try a new restaurant. Those additional peak period trips are called *generated traffic*, and the net increase in vehicle-kilometres is called *induced travel*.[8] Many factors affect the point of congestion equilibrium, including overall demand (number of residents and jobs), the quality of alternative mobility and accessibility options (walking, cycling, ridesharing, public transport, and now telework), travel demand management incentives (including road and parking prices), and land use development patterns.

19. Ignoring induced travel effects in the model exaggerates the benefits of roadway expansions and underestimates the benefits of lane reallocation and other multimodal transport improvements.

20. At paragraphs 225-227 and 235-243 Mr Bunn argues that regional population [[201.0336]]
growth will increase traffic congestion, so roadway expansions will not induce [[201.0339]]
additional vehicle travel. This is wrong. The level of traffic congestion resulting from population growth depends on which planning options are considered,

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[7] Jamey M. B. Volker, Amy E. Lee and Susan Handy (2020), "Induced Vehicle Travel in the Environmental Review Process," *Transportation Research Record* (doi.org/10.1177/0361198120923365).

[8] Todd Litman (2001), "Generated Traffic; Implications for Transport Planning," *ITE Journal*, Vol. 71, No. 4, Institute of Transportation Engineers (www.ite.org), April, pp. 38-47; at www.vtpi.org/gentraf.pdf.

and the amount of roadway expansion will be a major factor in the level of additional vehicle travel.

21. The question for consideration is how much induced vehicle travel and emissions would result from a highway expansion *compared with alternatives*. These could include doing nothing, so the congestion maintains its current equilibrium, reallocating road space to high occupancy vehicles or bus lanes, imposing road tolls, or implementing other incentives to manage travel demand.

22. At paragraph 235 Mr Bunn cites the Penlink project as an example of a new road that could reduce emissions. It is notable that the project would be tolled, which is a demand reduction strategy. Tolling the road would certainly reduce emissions compared to not tolling it. However, Penlink would reduce vehicle travel times, add roading capacity and essentially open up land for housing development. Each of these project characteristics mean it is likely to lead to a medium-term increase in traffic and emissions. [[201.0339]]

23. This is a prime example of the MSM model's limitations: by underestimating the induced travel and emissions, the model has supported an investment decision for over $800 million of public funds in new roading capacity that will increase emissions. Improvements for active and public transport in the area could have been provided more economically, and provided better social and environmental outcomes.

24. At paragraphs 239-243 Mr Bunn cites research by Bigazzi and Figliozzi to argue that, by increasing traffic from low to moderate speeds, roadway expansions reduce emission rates sufficiently to offset the emissions induced by increased vehicle travel. The argument is weak; the best Mr Bunn can conclude is: "This is also evidence that reading projects *will not automatically* result in increased tailpipe emissions – even when additional induced traffic is included." [[201.0341]]

25. The context of the research is that the authors were countering the dominant view that adding road capacity reduces emission. The authors outlined their modelling results and concluded that rather than increasing capacity, "emissions benefits can be better achieved using demand and vehicle-based emissions reductions strategies". Examples of demand-based strategies are tolling and reallocation of road space to other modes.

26. The research on induced vehicle travel consistently demonstrates that urban roadway expansions generally provide only short-term increases in traffic speeds. Congestion generally returns to previous levels within a few years, with greater traffic volumes and regional emissions. If the roadway improvements cause more sprawled, car-dependent development, this will further increase regional emissions.

Leverage effects

27. MSM appears to ignore the leverage effects that high quality public transport and transit-oriented development have on total per capita vehicle ownership and travel.[9] For example, commuters who normally drive to work must have a personal car that they are likely to use for most other trips, such as errands and socialising, resulting in high annual mileage. However, commuters who rely on public transport, and households that live in transit-oriented neighbourhoods, tend to own fewer cars, drive less, and rely more on non-car modes; the effects are transformational.

28. This effect is well documented and can have large follow-on effects. One major study found that high quality public transport *directly* reduces vehicle-travel fuel use and GHG emissions by just 2%, but by stimulating compact development, *indirectly* reduces vehicle travel, fuel use and emissions by 1-21% compared to a hypothetical scenario without public transport.[10] It found that adding a neighbourhood rail station, population and employment density within a 1-mile radius increases by 9%, which causes a 2% reduction in vehicle kilometres travelled, transport fuel use and emissions.

29. Research by Wedderburn found that in New Zealand urban areas, each additional daily public transport trip by driving age (age 18+) residents is associated with 0.95 more walking trips and 1.21 kilometres walked (in addition to the walking trips to access public transport), and reductions of two daily car driver trips and 45 vehicle-kms. This equates to approximately 5 kilometres of reduced vehicle travel for each additional public transport passenger-km.[11]

30. A comprehensive study of the long-term effects of transit-oriented developments in the Portland, Oregon region found that after 8-13 years the share of residents who drove alone to work four to five days a week fell from 58% to 46%; the share who never drove alone rose from 11% to 24%; the share who walked or biked to work at least one day a week rose from 9% to 29%; and the share living in low-car households (fewer cars than adults) increased from 34% to 50%, though the share of car-free household did not change.[12] Overall they found that indirect impacts are generally about four times larger than direct effects.

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[9] Jen McGraw, et al. (2021), *An Update on Public Transportation's Impacts on Greenhouse Gas Emissions*, TCRP 226, Transportation Research Board (https://doi.org/10.17226/26103); at www.trb.org/main/blurbs/181941.aspx.

[10] ICF (2010), *Current Practices in Greenhouse Gas Emissions Savings from Transit: A Synthesis of Transit Practice*, TCRP 84, TRB (www.trb.org); at www.trb.org/Publications/Blurbs/163614.aspx.

[11] M. Wedderburn (2013), *Improving the Cost-Benefit Analysis of Integrated PT, Walking and Cycling,* Research Report 537, NZ Transport Agency (www.nzta.govt.nz); at www.nzta.govt.nz/resources/research/reports/537.

[12] Nathan McNeil and Jeniffer Dill (2020), *Revisiting TODs: How Subsequent Development Affects the Travel Behavior of Residents in Existing Transit-Oriented Developments*, National Institute for Transportation and Communities (https://nitc.trec.pdx.edu); at https://ppms.trec.pdx.edu/media/project_files/NITC-RR-1240-Revisiting_TODs.pdf.

31. This indicates that public transport improvements are likely to provide vehicle travel and emissions reductions that are at least three times larger than what MSM predicts, and much more if those improvements are implemented in conjunction with vehicle travel reduction incentives – sticks as well as carrots.

32. To consider a specific example, at paragraph 217 Mr Bunn claims that a major shift in investment from highways to public transport improvements would only increase 2028 public transport mode share from 13.4% to 13.6% and would only reduce total emissions by 0.3% – a minor change. Similarly, at paragraph 221 he describes a modelling forecast that $5 billion cycling investments would only increase 2028 cycling mode share from 1% to 3.7%. [[201.0332]]

33. These are exactly the types of projects that MSM is likely to undervalue and underestimate, particularly if implemented as part of an integrated programme that gives travellers more incentives to reduce driving and shift to resource-efficient modes.[13] For example, car to public transport mode shifts tend to increase substantially if commuters have commute trip reduction programmes, priced parking or parking cash out. There is no indication that such incentives were considered in the modelling Mr Bunn cites. [[201.0365]]

34. Due to leverage effects, the vehicle travel impacts of high-quality public transport services implemented with transit-oriented development policies and active transport improvements (e.g., improved pavements and paths, complete streets roadway designs, and urban traffic speed reductions) are likely to provide two to four times the vehicle travel reductions and associated benefits as MSM predictions, providing far higher returns on investment.

Experience in peer regions

35. At paragraph 224 Mr Bunn argues that "the modelling evidence demonstrated that investment in infrastructure and services has only a minor impact on regional scale emissions." At paragraph 330 he appears to criticise me for using Paris in my first affidavit as an example of a city where transport investment decisions have had a significant impact on vehicle traffic and emissions. [[201.0335]]

36. Experience in many other cities confirms that large changes are possible. For example, a set of public transport improvements and travel demand policies reduced Puget Sound (Seattle, Washington) region per capita vehicle travel by 6% and increased public transport ridership by 20% between 2010 and 2018.[14] Similarly, London's bus service improvements and travel demand management incentives reduced private vehicle mode share from 49% to 36%, and increased public transport share from 25% to 37%.[15]

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[13] FHWA (2012), *Integrating Demand Management Into The Transportation Planning Process: A Desk Reference*, U.S. Federal Highway Administration (https://ops.fhwa.dot.gov); at https://ops.fhwa.dot.gov/publications/fhwahop12035/index.htm.

[14] PSRC (2019), *Vehicle Miles Travelled*, Puget Sound Regional Council (www.psrc.org); at www.psrc.org/sites/default/files/trend-vmt-201911.pdf.

[15] Phillip Rode and Christian Hoffman (2015), *Towards New Urban Mobility: The Case of London and Berlin*, LSE Cities (https://lsecities.net) and InnoZ; at https://lsecities.net/publications/reports/towards-new-urban-mobility.

37. I note that these concepts have been accepted in Australia. In December 2021, Engineers Australia released a discussion paper that highlighted the problems with the current transport planning paradigm:[16]

> Attempts to "bust congestion" with major road widening projects have generally been unsuccessful... investment has been poorly targeted. Increasing capacity for urban road networks induces demand and is a major reason for increased traffic on the network... [[312.5217]]
>
> There is little evidence to demonstrate increasing road capacity to reduce traffic congestion improves economic performance in cities (Sweet, 2011). A focus on changes in access times for catchments would be more reliable...
>
> The need for change is evidenced by the failure of past transport policies to address the challenge of climate change, deaths, and serious illness from vehicles emissions...
>
> Infrastructure Australia (2019) is one of many organisations that has recognised the need to move away from the traditional planning approach of "predict and provide", based largely on an extrapolation of past trends, to a more forward looking "vision and validate" model. The International Transport Forum (ITF, 2021) has noted the "predict and provide" paradigm, that has existed since the 1950s, has the effect of increasing capacity to keep up with demand growth and that this leads to increasing levels of traffic on the road network...

38. Many urban regions similar to Auckland are implementing strong travel demand management incentives and sustainable transport and land use planning policies to help achieve climate emissions reduction targets. For example, the UK's Department for Transport recently warned local authorities that major road projects will not receive central government funding if they are likely to increase carbon emissions, or fail to support walking, cycling and public transport.[17] This decision partly reflects research showing that highway expansions tend to increase vehicle traffic, which reduces their congestion reduction benefits, leading to poor benefit to cost ratios (**BCR**), often much lower than for non-car modes. For example, the Department for Transport found BCRs for cycling projects up to 35 to 1, much higher than the 4.7 average BCR for highway improvements.

39. Many jurisdictions have established vehicle travel reduction targets. For example, California state law requires that per capita vehicle travel be reduced 15% by 2050, and the state has developed analysis tools for evaluating major transport and land use projects to ensure they support this target.[18] Washington State requires 30% reductions by 2035 and 50% by 2050, and has established commute trip reduction programmes and requirements to support

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[16] Engineers Australia (2021), *Urban Transport Systems: A Transport Australia Society Discussion Paper*, (https://www.engineersaustralia.org.au); at https://bit.ly/37O86bH. [[312.5212]]
[17] Carlton Reid (2022), "Major New Roads In England May Have Funding Pulled If They Increase Carbon Emissions Or Don't Boost Active Travel", *Forbes* (www.forbes.com); at https://bit.ly/3q72uQ9.
[18] Caltrans (2020), *Vehicle Miles Traveled-Focused Transportation Impact Study Guide*, California Department of Transportation (https://dot.ca.gov); at https://bit.ly/3DDSm5H.

those targets.[19] British Columbia's target is to reduce light-duty vehicle travel 25% between by 2030 and to approximately double walking, cycling and public transport to 50% mode share by 2050; the province is reforming its transport policies and programmes to support those goals.[20]

40. Vancouver, which is similar to Auckland in demographics and geography, has achieved its vehicle-travel reduction targets, reducing automobile mode share from 45% in 2013 to 40% in 2019, a 9% decline in six years of strong economic growth.[21]

41. The report *Reducing Car Dependence in the Heart of Europe*[22] found that cities in Germany, Austria and Switzerland have significantly reduced automobile travel, despite high levels of wealth and vehicle ownership. This was accomplished through an integrated programme of policies that favour walking, cycling and public transport over car travel in roadway design, pricing and land use policies. These reductions include: Berlin, 38% (1998) to 30% (2013); Hamburg, 47% (2002) to 42% (2008); Munich, 41% (2002) to 33% (2011); Vienna, 37% (2000) to 27% (2012); and Zurich, 40% (2000) to 30% (2010).

42. In short, the gross inaccuracies in the MSM model, and the discrepancies between the very small impacts that the model predicts, and the experience of successful peer cities, indicates that the predictions Mr Bunn cites are inaccurate and biased in favour of roadway expansions and against mode shift and traffic reduction solutions.

Effects of roadway supply on vehicle travel

43. One key factor that affects how much urban residents drive is roadway supply. Per capita roadway supply varies significantly; as it increases, per capita automobile travel also tends to increase. Figure 5 below illustrates the positive relationship between per capita road-miles and vehicle-miles travelled among U.S. urban regions.

44. Of course, this effect can go both ways: increased vehicle travel can be used to justify more roadway investments. But there is little doubt that, all else being equal, expanding urban roadways increases automobile travel by degrading walking and cycling conditions, displacing high-access urban neighbourhoods, and making driving more convenient.[23] For example, a study titled "Did Highways Cause Suburbanization?" estimated that one new

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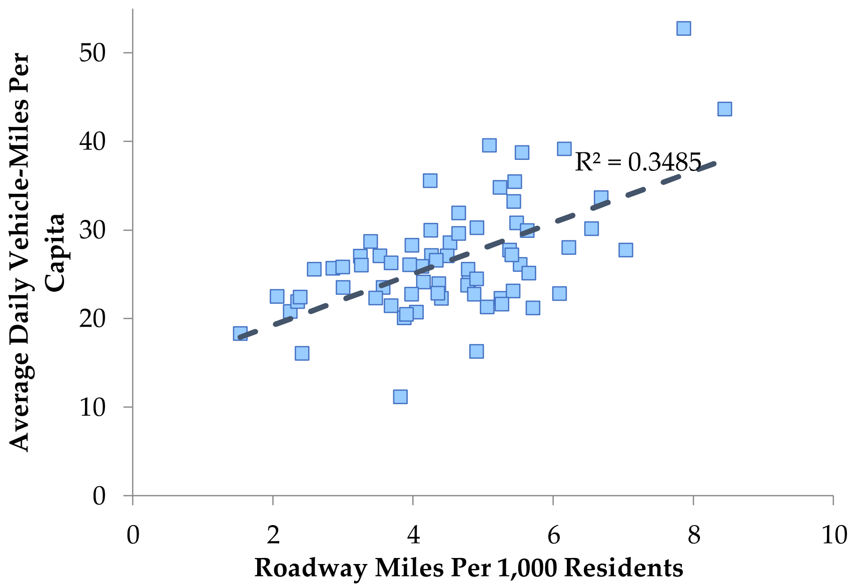
[19] WSL (2008), *Adoption of Statewide Goals to Reduce Annual Per Capita Vehicle Miles Traveled by 2050*, Washington State Legislature (https://apps.leg.wa.gov); at https://apps.leg.wa.gov/RCW/default.aspx?cite=47.01.440.
[20] CleanBC (2021), *Roadmap to 2030*, British Columbia (www.gov.bc.ca); at https://bit.ly/3BG5INs.
[21]McElhanney (2021), *2020 Vancouver Panel Survey*, City of Vancouver (https://vancouver.ca); at https://vancouver.ca/files/cov/2020-transportation-panel-survey.pdf.
[22]Ralph Buehler, et al. (2016), *Reducing Car Dependence in the Heart of Europe: Lessons from Germany, Austria, and Switzerland*, Transport Reviews (http://dx.doi.org/10.1080/01441647.2016.1177799).
[23] Volker, Lee and Handy (2020).

highway passing through a central city reduces its population by about 18% and increases sprawled, automobile-oriented development patterns.[24]

Figure 5 **Daily vehicle-miles in U.S. urban regions**[25]



45. Conversely, research indicates that reducing roadway supply often reduces vehicle travel and congestion. A recent study by the International Transport Forum (**ITF**), which is a section of the OECD, concludes: "There is a growing body of evidence to suggest that well-planned measures that reduce road space for private cars do not add to congestion. On the contrary, reductions in road capacity can lead to 'disappearing traffic'."[26]

46. At paragraphs 268-288 Mr Bunn discusses the effects of reducing road capacity, and mentions the references cited in Ralph Chapman's and my first affidavits. One of these was a report by the ITF, which he says "principally relies" on a paper which is more "nuanced" than the report itself. Mr Bunn then proceeds to report some of the findings of the paper, and make some inferences from them. [[201.0348]]

47. The ITF report does not "rely principally" on this study. The report references it as the most comprehensive study on the topic, outlines its findings, and then presents evidence acquired over the 23 years since the study was published. This more recent evidence includes research done in Oslo, Copenhagen, Paris, Milan, Dublin, Brussels, Copenhagen and Bogota.

48. It is not that the earlier Goodwin paper is more "nuanced" – a term Mr Bunn seems to have introduced because Goodwin et al. recommended against using a rule of thumb to calculate how much traffic evaporation there would be. The

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[24] Nathaniel Baum-Snow (2007), "Did Highways Cause Suburbanization?", *Quarterly Journal of Economics*, Vol. 122/2, pp. 775-805; at https://bit.ly/38HBxdi.
[25] FHWA (2020).
[26] ITF (2021), *Reversing Car Dependency*, International Transport Forum (www.itf-oecd.org); at https://bit.ly/3JesDDU. [[304.1823]]

ITF report was written after 23 more years of research. The report was "based on expert discussion held at the ITF Roundtable on 'Zero Car Growth? Managing Urban Traffic' on 16 and 17 December 2019 in Paris" where five discussion papers on the topic of road reallocation were presented, by researchers – including Goodwin himself.

49. The inference Mr Bunn makes at paragraphs 281 is not logical: as lane reallocation to other modes becomes more widespread, the networks for those other modes grow larger, allowing the network effects to offer more opportunities, not fewer, for people to adjust. [[201.0352]]

Effects of congestion and road space reallocation on emissions

50. Road space reallocation is often used in cities to increase roadway efficiency, and people per lane-kilometre; to ensure that non-drivers receive their fair share of road space; to favour resource-efficient modes; and to create more attractive and liveable streets. This is sometimes called "complete streets" planning, or "streetscaping." The report *Reversing Car Dependency* by the ITF concludes:[27] [[304.1829]]

> Reallocation of road space is used more widely than road pricing to manage car use. Possibly, it is seen as more acceptable in view of concerns over the equity impacts of road pricing. The most effective urban mobility management systems deploy road pricing schemes together with road space allocation and land-use planning instruments. High priority for more sustainable forms of transport will drive a more efficient use of road space, enhance the attractiveness of non-motorised modes and improve the accessibility of specific locations. It will also reduce damage to the environment, make street space more attractive and improve road safety for non-motorists.

51. These studies demonstrate that road space reallocation can increase roadway efficiency and equity, and reduce vehicle emissions.

52. At paragraphs 257-263, and elsewhere, Mr Bunn argues that traffic congestion significantly increases per-kilometre emission rates, and that roadway expansions therefore often reduce emissions, and that road space reallocation from cars to other modes may increase emissions. He asserts (paragraph 257): [[201.0346]]

> …reductions in emissions per kilometre, associated with reductions in congestion, were at least as important as reductions in distance travelled in contributing to the RLTP's overall emission reductions. The implication was that interventions, such as large-scale lane removal, that lead to an increase in congestion or a reduction in local road travel speeds, will also lead to an increase in emissions per kilometre travelled for remaining traffic. This increase would likely largely offset the emissions reduction associated with reduced traffic.

[27] ITF (2021), *Reversing Car Dependency*, International Transport Forum (www.itf-oecd.org); at https://bit.ly/3JesDDU. [[304.1823]]

53. This is almost always not the case for the following reasons:

(a) Additional road capacity will increase speeds and lower rates of congestion at all times of the day and week, with a range of effects on emissions, depending on the level of congestion and speed at that time. Emissions at peak hour could easily drop (in the short term) due to the relief of heavy congestion, but at times of lower traffic volumes the increase in speeds will likely cause emissions to increase.

(b) Generated traffic (additional peak-period vehicle trips) generally fills the added capacity within a few years, so reductions in per-kilometre emission rates tend to be temporary. For example, one major study found that U.S. vehicle miles travelled increase in proportion with lane-mileage, and the congestion relief of road capacity expansion generally vanishes within five years.[28] Within a few years any reduction in emission rates disappears and the total number of emitters increases.

(c) Roadway expansions induce additional vehicle-kilometres. For example, a recent technically sophisticated study of 545 European cities indicates that urban highway expansion tends to increase vehicle traffic and so fails to solve congestion.[29] The analysis indicates that each 1% increase in highway lane-kilometres typically increases total vehicle kilometres by 1.2%. It found significantly less congestion in cities with road pricing and high quality rail transport. Conversely, before-and-after studies indicate that roadway capacity reductions generally reduce total vehicle travel,[30] an effect called *disappearing* or *evaporating* traffic.[31]

54. The claims that Mr Bunn makes at paragraphs 257-263 appear to rely on the outputs of the MSM modelling that Auckland Transport has conducted. As I have addressed above, however, the biases and omissions of the model mean that it cannot be relied upon to support the conclusions that Mr Bunn seeks to advance. [[201.0346]]

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[28] Kent Hymel (2019), "If You Build it, They Will Drive: Measuring Induced Demand for Vehicle Travel in Urban Areas," *Transport Policy*, Vo. 76, pp. 57-66 (doi.org/10.1016/j.tranpol.2018.12.006).

[29] Miquel-Àngel Garcia-López, Ilias Pasidis, and Elisabet Viladecans-Marsal (2020), *Congestion in Highways when Tolls and Railroads Matter: Evidence from European Cities*, Universitat Autonoma of Barcelona (https://ecap.uab.cat/RePEc/doc/wpdea2011.pdf), Ideas (https://ideas.repec.org); at https://ideas.repec.org/p/uab/wprdea/wpdea2011.html.

[30] Sally Cairns, Stephen Atkins and Caltrans (2020), *Calculating and Forecasting Induced Vehicle Miles of Travel Resulting from Highway Projects: Findings and Recommendations from an Expert Panel*, California Department of Transportation (https://dot.ca.gov); at https://bit.ly/3nwaf10.

[31] ITF (2021), *Reversing Car Dependency*, International Transport Forum (www.itf-oecd.org); at https://bit.ly/3IgFdl1. [[304.1823]]

Economic, social and cultural effects of road space reallocation

55. At paragraphs 179 and 264-267, Mr Bunn argues that lane reductions would have negative economic, social and cultural impacts, based on access to jobs, which he considers an indicator of access to other services and activities. He says at paragraphs 266 and 267: [[201.0320]] [[201.0347]]

> In 2031, even with the RL TP in place, around 71% of commuting to work is still expected to occur by private vehicle - so remains critical to labour force participation and employment availability to workers. In the lane reduction scenario, the increase in congestion and consequent decline in travel speed means that morning peak private vehicle access to employment within 30 minutes drops by 22%, from 266,066 in the 2031 RLTP scenario to 208,058 in the lane removal scenario. In this scenario, access to employment in 2031 would also be 11% lower than the 2016 figure of 233,647 - despite employment numbers increasing by 17% over the same period. This reduction is not offset by an increase in access to public transport, which drops by 5%, from 108,160 in the RL TP to 103,166 in the scenario due to the impact of congestion on bus operations. [[201.0348]]
>
> The modelling figures demonstrate that a widespread lane reduction programme would lead to a very significant reduction in access to employment/ labour force opportunities, which would in turn impact on individual and collective economic welfare. A similar impact on access to other social and cultural opportunities - including access to essential services - can also be expected. In my opinion, the results provide clear evidence of the negative impact on effectiveness 55 and economic, social and cultural wellbeing.

56. This further indicates that the analysis is incomplete and the modelling inaccurate. A major reallocation of road space should improve rather than degrade bus service, as well as improving walking and cycling conditions. The model appears to assume that few travellers will shift mode, and few businesses will choose more accessible, multimodal locations in response to significant walking, cycling and public transport improvements implemented in conjunction with other travel demand management incentives and sustainable transport and land use planning policies.

57. Similarly, most experts conclude that efficient road and parking pricing – tolls and fees that increase with congestion and are lower during off-peak periods – can increase accessibility and social equity overall, provided that some of the revenues are used to improve non-car travel options, and land use policies support affordable housing in walkable urban neighbourhoods.[32] This occurs because lower-income households have relatively low vehicle ownership and peak-period vehicle travel rates, and benefit significantly from improvements to affordable modes and accessible housing options. As a result, it is inappropriate to assume that pricing reforms and other travel demand management incentives necessarily have negative economic, social and cultural wellbeing impacts: a well-designed programme can help achieve these goals.

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[32]ITF (2018), The Social Impacts of Road Pricing Summary and Conclusions, International Transport Forum (http://www.itf-oecd.org); at https://bit.ly/3N1oZjl.

58. These examples indicate that more multimodal planning and more compact development generally increases overall accessibility, particularly for physically and economically disadvantaged people who rely on inclusive and affordable modes. For example, the study "Does Accessibility Require Density or Speed?" found that more dense, mixed and multimodal regions provides more accessibility overall because slower travel speeds are more than offset by greater proximity.[33]

59. To the degree that Auckland can accommodate population growth through infill development in high-accessibility neighbourhoods, create more mixed-use "urban villages" where commonly-used services are easy to reach by walking and cycling, and improve and encourage space-efficient modes (walking, cycling and public transport), overall accessibility should increase, particularly for people who cannot or choose not to rely on cars for most of their travel.[34]

60. At paragraph 255 and 256 Mr Bunn argues that there will be negative impacts from lane reallocation "without additional effective alternatives". Again, at paragraph 268 he claims that "lane removal does not improve transport choices, as no new alternative is provided". The point is that lane removal is an opportunity to provide the alternatives at low cost. The relevant questions that remain are why lane reallocation, a methodology that provides excellent value-for-money by re-utilising existing infrastructure, featured so little in the RLTP, and why Mr Bunn considers that it would have negative economic, social and cultural impacts. [[201.0345]] [[201.0348]]

61. I have been shown a paper prepared by Auckland Council for a committee meeting on 2 December 2021 regarding a Transport Emission Reduction Plan that is being developed for Auckland. It says:[35]

> Many of the low carbon policies and investments introduced for emissions reduction purposes would also achieve other social, cultural, environmental, and financial objectives for the region. These include greater access and travel choice, improved public health and road safety, reduced transport costs, improved air quality and noise levels, and greater community resilience. [[312.5242]]

62. I entirely agree with that assessment. The basis of Mr Bunn's contrary view remains unclear to me.

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[33] Jonathan Levine, et al. (2012), "Does Accessibility Require Density or Speed?" *Journal of the American Planning Association*, Vol. 78, No. 2, pp. 157-172, http://dx.doi.org/10.1080/01944363.2012.677119; at http://tinyurl.com/cpdmmf6.

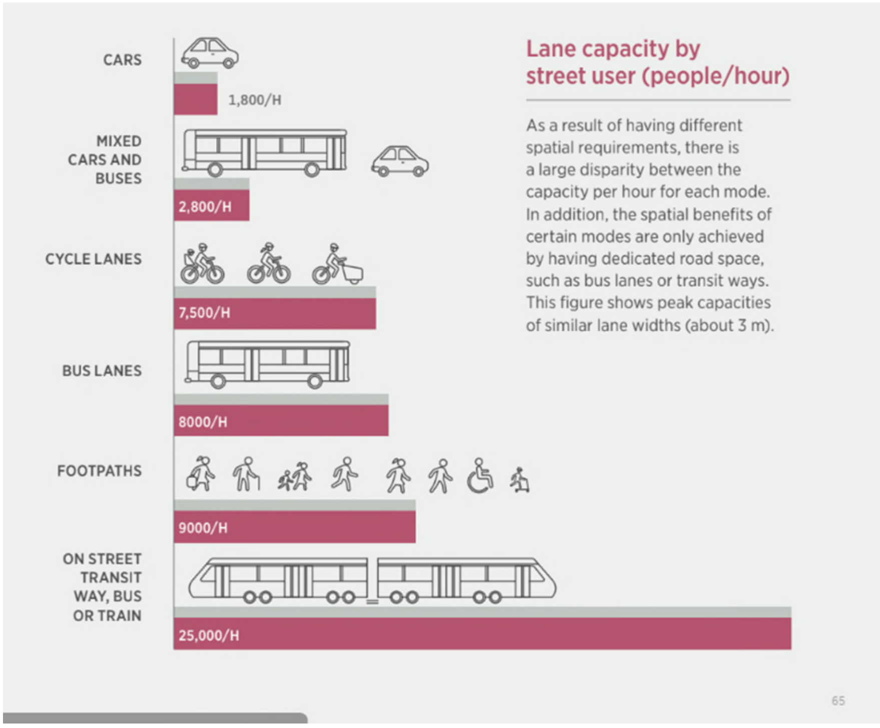
[34] David M. Levinson and Hao Wu (2020), "Towards a General Theory of Access," *Journal of Transport and Land Use*, Vo. 13(1), pp. 129-158 (https://doi.org/10.5198/jtlu.2020.1660).

[35] https://infocouncil.aucklandcouncil.govt.nz/Open/2021/12/ECC_20211202_AGN_10127_AT.PDF.

63. At paragraphs 268-294 Mr Bunn argues that road space reallocation will cause insufficient reduction in vehicle travel (i.e., traffic will not disappear) resulting in congestion delays, reduced accessibility and increased emissions. I respectfully disagree with the way he frames the issue: at paragraph 281 he describes road space reallocations as "road capacity reductions". As discussed above, road space reallocation is an opportunity to provide space for alternative modes: these changes may *reduce capacity for automobiles* but since cyclists and bus passengers are far more space efficient than motorists, road space reallocation can greatly *increase total person throughput*. [[201.0348]] [[201.0352]]

64. Auckland Transport's own Transport Design Manual[36] illustrates the lane capacity improvements of converting a general traffic lane into any other mode, be it a cycle lane, footpath or bus lane. This can provide large gains in mobility and accessibility, particularly for non-drivers, as illustrated in Figure 6 below.

Figure 6 **Lane capacity by street user[37]**



[36] Auckland Transport, *Urban Street and Road Design Guide*, Transport Design Manual, https://at.govt.nz/media/1980686/urban-street-and-road-design-guide.pdf.

[37] https://at.govt.nz/media/1980686/urban-street-and-road-design-guide.pdf.

65. Extensive research from other cities further indicates that improvements to resource-efficient modes (walking, cycling and public transit), together with travel demand management incentives and development policy reforms, can improve the efficiency and equity of the transport system. One major study applied several state-of-art integrated transport and land use impact models to the Sacramento, California region, which happens to be similar to Auckland in size, vehicle ownership and density. [38] It also evaluated the results of travel models in various U.S. and European cities.

66. The study showed that properly planned road space reallocation, implemented with complementary travel demand management incentives and sustainable transport and land use development policies, tends to reduce congestion delays, increase roadway productivity (passenger-kilometres per road-kilometre), increase overall accessibility, provide economic benefits, and increase equity, in addition to helping to achieve emission reduction goals. This suggests that MSM, like other older traffic models, underestimates the impacts and benefits of walking, cycling and public transport improvements.

67. Even if it were true that road space reallocation reduces overall accessibility (which it is not), it is likely to improve accessibility for the people who need it most: people who cannot drive or are financially stressed by automobile costs and so benefit directly from improved walking, cycling and public transport.

68. Properly planned road space reallocation almost certainly reduces accessibility disparities between drivers and non-drivers, and between wealthy and lower-income travellers, particularly if implemented with complementary improvements in active travel conditions, and more affordable housing in walkable and public transport rich neighbourhoods. Road space reallocation therefore helps achieve social equity goals. The Waka Kotahi, *Monetised Benefits and Costs Manual*, requires that such impacts be quantified and reported.[39]

69. To evaluate these impacts the model must accurately predict the portion of travellers, particularly peak-period travellers, who will shift from driving to resource-efficient modes if driving becomes slower and less reliable, and cycling and public transport become faster and more reliable. Mr Bunn says at paragraph 266 that MSM indicates that such shifts will be small – the model [[201.0348]] predicts that 71% of commuters will continue to commute by car. There are many reasons to be more optimistic, particularly if road space reallocation is implemented with travel demand management incentives.

[38] Caroline J. Rodier, John Abraham and Robert A. Johnston (2002), *A comparison of Highway and Travel Demand Management Alternatives Using an Integrated Land Use and Transportation Model in the Sacramento Region*, Transportation Research Board Annual Meeting; at www.des.ucdavis.edu/faculty/johnston/radB7739.pdf. The key findings of the study were reviewed here: Robert Johnston (2006), *Review of U.S. and European Regional Modeling Studies of Policies Intended to Reduce Motorized Travel, Fuel Use, and Emissions*, Environmental Science & Policy, University of California, Davis; at www.vtpi.org/johnston.pdf.

[39] Waka Kotahi (2021), *Monetised Benefits and Costs Manual*, New Zealand Transport Agency (www.nzta.govt.nz); at www.nzta.govt.nz/resources/monetised-benefits-and-costs-manual.

70. In fact, Auckland is already implementing additional travel demand management incentive,s and sustainable transport and land use planning policies, that will reduce demand for automobile travel and increase demand for non-car modes. For example, the city recently eliminated parking minimums and upzoned neighbourhoods that currently only allow low-density single-family housing. These reforms should reduce parking supply and increase the portion of new homes located in high-access urban areas, which reduces car ownership and use, and increases demand for walking, cycling and public transport beyond what MSM would have predicted.[40]

The level of investment involved

71. At paragraph 333 Mr Bunn argues that it is "factually incorrect and misleading" to say that much of the budget is allocated to building new roads and renewing existing ones. In fact, the RLTP budget shows over $1 billion allocated to new roads, nearly $1 billion in road widening, and over $3 billion in projects that would be much cheaper if road reallocation was used. This is all in addition to the over $2 billion in greenfield transport infrastructure, some of which will be new or widened roads or intersections. [[201.0366]]

72. At paragraph 248 Mr Bunn claims: "*Some* of the renewals budget could theoretically have been used to fund other projects, including the reallocation of road space towards sustainable modes. However, the AT Board and RTC were well aware of these trade-offs." There is nearly $4 billion in Auckland Transport's renewals budget and some large proportion of the Waka Kotahi $1.8 billion State Highway Maintenance, Operations & Renewals budget that could effectively and affordably have been applied to lane reallocation. [[201.0344]]

73. Many cities are requiring all projects, including renewals projects, to implement elements of the "Complete Streets" programme, except the most minor maintenance jobs. Examples include Cambridge, Boston[41], which requires that "protected cycling lanes be installed on all streets that are slated for reconstruction under existing city plans". Burlington, Virginia, has merged tactical innovation with its public works programme, including renewals. Utrecht has significantly improved its cycling network by systematically installing cycling infrastructure on appropriate streets at each renewal. This approach would help Auckland to quickly create the missing cycling network and deliver sustainable travel choices.

74. This is particularly important as new "micromodes" such as e-scooters and e-bikes significantly expand the portion of trips that can be made by small vehicles. recent Waka Kotahi report estimates that micromobility mode share

[40] Omid Khazaeian (2021), *Estimating The Impact of Parking on Car Ownership and Commute Mode Choices*, Te Herenga Waka-Victoria University of Wellington (https://doi.org/10.26686/wgtn.16575005.v1).

[41] Bliss, L, Bloomberg CityLab Transportation, *Cambridge's New Bike Lane Law is 'Bikelash'-Proof* https://www.bloomberg.com/news/articles/2019-04-11/cambridge-s-ambitious-protected-bike-lane-law.

will be between 3% and 11% by 2030; and that by improving access to buses and trains, micromobility could increase transit travel by 9%.[42]

75. Another recent New Zealand study found that after commuters obtained an e-bike at least 50% of e-bike trips replaced car trips.[43] Car trip replacement also increased as the length of e-bike ownership increased, a finding that suggests the ongoing accrual of mode shift outcomes over time. The traffic reduction impacts, and resulting economic, social and environmental benefits, that could be achieved if Auckland significantly expanded its cycling network to accommodate this demand are potentially very large. Shifting money and road space from automobile traffic and parking to bike lanes and multiuse paths is essential to achieving these goals.

76. At paragraph 334 Mr Bunn explains that "underfunding a renewals programme will lead to increased whole of life costs". Cities harnessing their renewals budget to improve their streets are not underfunding their renewals, but are optimising the return from the investment. [[201.0366]]

Self-fulfilling planning

77. The MSM, on which Mr Bunn relies throughout his affidavit, perpetuates what critics call "predict and provide planning", which tends to create self-fulfilling prophecies. Past growth trends are extrapolated to the future, predicting severe traffic and parking congestion, justifying roadway and parking facility expansions that soon fill with induced vehicle travel, which then justify the original predictions.[44] This is illustrated in Figure 7 below.

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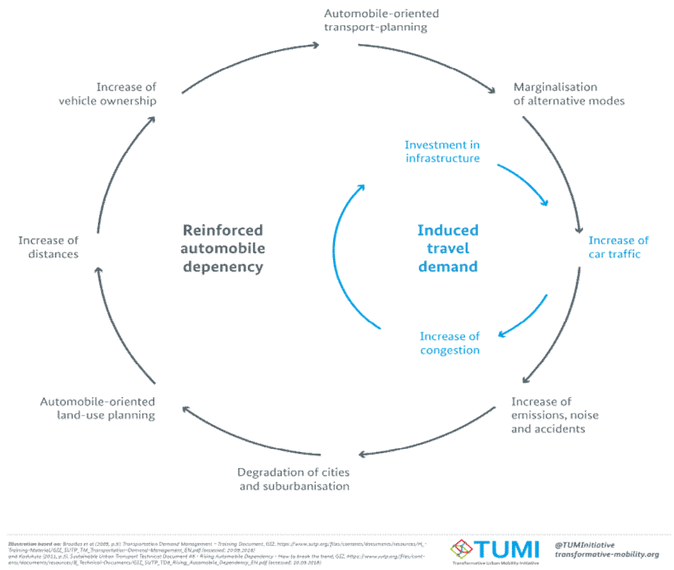
[42] M. Ensor, O. Maxwell and O. Bruce (2021), *Mode Shift to Micromobility*, Research Report 674, NZ Transport Agency (www.nzta.govt.nz); at www.nzta.govt.nz/assets/resources/research/reports/674/674-Mode-shift-to-micromobility.pdf.

[43] Michael Blewden, et al. (2021), *Impacts of a Public Sector E-bike Scheme*, Report 678, Waka Kotahi NZ Transport Agency (www.nzta.govt.nz); at https://bit.ly/39dvzAh.

[44] Engineers Australia (2021).

Figure 7 **The cycle of automobile dependency and sprawl**[45]



This figure illustrates the self-reinforcing cycle of automobile dependency and sprawl. Increased investment in roadway infrastructure induces traffic.

78. If planners had used different assumptions and methods, for example, by using cost-recovery tolls and fees to test motorists' willingness to pay for expanded roadways and parking facilities, demand for automobile travel would have grown much less, and travellers would have relied more on resource-efficient modes.

79. For example, at paragraph 224(b) Mr Bunn states: [[201.0335]]

> The fact that the urban form of the city is already largely set, leading to a wide distribution of trip origins and destinations. For example, the typical Aucklander currently travels an average of 10.9 kilometres to work, 5.9 kilometres to reach preferred shopping destinations and 8.6 kilometres to reach preferred social/ personal destinations, with an average of 8.2 kilometres across all trip purposes. These distances tend to support the use of motorised modes, although this may change with E-Bikes. More widely, in terms of the discussion to follow, it also suggests that Aucklanders will struggle to significantly reduce their distance travelled without also losing access to opportunity

80. These statistics indicate that Auckland is now relatively automobile dependent and sprawled, which means that large vehicle travel reductions are possible. Currently, many households live in single-family homes in residential-only neighbourhoods that contain limited services; most adults own a personal vehicle which they rely on for most trips; they receive unpriced parking at most destinations; and Auckland has relatively high public transport fares. Although few motorists want to give up driving altogether, consumer surveys indicate that many would prefer to spend less time and money on driving, to rely more on non-car modes, and to live in a walkable urban neighbourhood

[45] TUMI (2019), *Vicious Cycle of Automobile Dependency*, Transformative Urban Mobility Initiative (TUMI); at https://bit.ly/3iaa3RD.

with more nearby services.[46] Serving these demands by building more infill housing, and shifting investments and road space from cars to non-car modes, responds to latent demand in ways that reduce vehicle travel.

81. Similarly, at paragraph 210 Mr Bunn states: "the scale of reduction needed – to meet Paris targets, for example – is not set at the local level. Even large local changes remain small in comparison to regional or national level targets." Yet other parts of central and local government in New Zealand *are* implementing travel reduction policies, including, for example, eliminating parking minimums, allowing more infill development, and possibly implementing road pricing or distance-based insurance premiums. [[201.0329]]

82. ATAP and the RLTP should therefore have assumed that automobile travel demands, and the economic benefits of roadway expansions, would decline, while demand for walking, cycling and public transport travel would increase. As a result, regional travel models should adjust assumptions about future traffic growth; project economic evaluation should adjust assumptions about consumer travel demands and benefits; and governments and local authorities should rationally shift resources from automobile-oriented to multimodal transport.

SWORN at Victoria, British Columbia, Canada this 22nd day of March 2022 before me:

Todd Alexander Litman

A person authorised to administer oaths by the laws of British Columbia, Canada

LISA STEVENSON
NOTARY PUBLIC
110 - 777 BROUGHTON ST.
VICTORIA BC V8W 1E3
MY COMMISSION IS PERMANENT

[46] Auckland Council (2015), *The Housing We'd Choose A Study of Housing Preferences, Choices and Trade-Offs in Auckland*; at www.smartgrowthbop.org.nz/media/1631/june-the-housing-we-choose-akl.pdf.
www.smartgrowthbop.org.nz/media/1631/june-the-housing-we-choose-akl.pdf