Under	the Resource Management Act 1991
In the matter of	hearings of submissions and further submissions on the Proposed Wellington City District Plan
By	**Wellington's Character Charitable Trust Inc** Submitter

STATEMENT OF EVIDENCE OF TIMOTHY HELM

7 FEBRUARY 2023

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INTRODUCTION

1. My full name is Timothy Walter Helm.

Qualifications and Experience

2. I am an independent economic consultant covering transport, housing, tax policy, and environmental regulation.

3. I have previously worked as a Senior Consultant at Ernst & Young, a Senior Economist at the Victorian Treasury (Australia), and a Senior Associate at the Grattan Institute.

4. I have a PhD in Economics from Melbourne University, a Masters in Economics (Hons) from Melbourne University, and a joint Bachelor of Commerce (Hons) / Bachelor of Science from Victoria University of Wellington.

5. My transport economics work has included cost-benefit analysis, business case preparation, working with technical transport models, advising on transport demand, and analysing public transport patronage.

6. My housing economics work has included analysis of land and housing taxes, developer contributions, land and housing market impacts of transport projects, and project value capture.

7. I have attached a copy of my CV to this statement of evidence.

Scope of Evidence

8. I have been engaged by Wellington's Character Charitable Trust.

9. Wellington's Character Charitable Trust has filed a submission that supports the position taken by Council in the notified Proposed District Plan (PDP) that the Johnsonville line stops are not rapid transit stops. I understand that other submissions have been lodged that take the opposing position and ask for the Johnsonville line stops to be treated as rapid transit stops with consequential upzoning under the National Policy Statement on Urban Development (NPS-UD).

10. My expert evidence provides my independent assessment of whether the Johnsonville rail line meets the requirements to be treated as a rapid transit

service for NPS-UD purposes, and what the consequences would be of a decision to classify the Johnsonville line as rapid transit. I also provide a response to the relevant parts of the WCC officers' section 42A report.

Code of Conduct

11. I have read the Code of Conduct for expert witnesses in the Environment Court Practice Note 2023 and I have complied with it when preparing this evidence. My evidence is within my area of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.

EXECUTIVE SUMMARY

12. The Johnsonville line service cannot be classified as rapid transit for NPS-UD purposes by process or definition alone. There exists no document that can settle this question without regard to empirical facts about the line. Waka Kotahi's One Network Framework is not an appropriate tool for this, as has been suggested in the Regional Land Transport Plan 2021.

13. It is necessary instead to assess the service against the NPS-UD criteria of frequent, quick, reliable and high-capacity. As there are no external standards or expert consensus over the appropriate metrics for these criteria, judgement is required as to appropriate benchmarks.

14. The Johnsonville line service:

    (a) does not have the frequency required of a rapid transit service, as it does not meet the minimum standard expected for 'turn up and go' transit (a 10 minute frequency), which is the most sensible benchmark for rapid transit frequency;

    (b) is not time-competitive with vehicle travel except in relation to a small subset of trips by residents along the corridor, which means it cannot be considered sufficiently 'quick' to meet a rapid transit standard;

    (c) does not have capacity to support expected population growth, and will likely experience crowding issues within 5-10

years and be overrun within 20 years, with local roads also becoming significantly more congested.

15. I therefore do not consider the Johnsonville line can be considered a rapid transit service in its current form.

16. There are no plans to improve the frequency, speed or capacity of the line to rapid transit standard. Business cases to date have not identified specific interventions or supported funding to achieve this.

17. Classifying the Johnsonville line as rapid transit will reduce citywide housing density, reduce active and public transport mode share, increase car dependency, and worsen the performance of the transport network, while doing nothing to increase housing supply and improve housing affordability across Wellington as a whole.

18. Classifying the Johnsonville line as rapid transit will not support the NPS-UD objective of well-functioning urban environments, nor will it necessarily increase public and active transport use, reduce greenhouse gas emissions, or result in lower apartment prices, all of which are claimed in the Council officers' section 42A report.

MATERIAL REVIEWED

19. In preparing this statement of evidence I have reviewed the following materials:

    (a) Wellington City Council's PDP Section 32 Evaluation Report – Part 1: Context to s32 evaluation and evaluation of proposed Strategic Objectives

    (b) Wellington City Council Proposed District Plan – Section 42A report for Hearing Stream 1

    (c) Review of the designation of the Johnsonville Railway Line as a Rapid Transit System by Lawrence Collingbourne, Tony Randle and Julie Ward (18 May 2022)

    (d) National Policy Statement on Urban Development (2020)

(e) Waka Kotahi/NZTA's One Network Framework (ONF) (November 2022) and earlier discussion documents created in the preparation of the ONF.

(f) Greater Wellington Regional Council's Regional Land Transport Plan (2021)

(g) Greater Wellington Regional Council's Wellington Rail Programme Business Case (July 2022)

(h) Property Economics' Commercially Feasible Residential Capacity Assessment documents for WCC (October 2021, June 2022, and November 2022)

(i) Auckland Council's Rapid Transit Baseline document (2021)

(j) Various transport and economics publications which are footnoted in my evidence.

CONTEXT

20. I begin my evidence by setting out three contextual points that inform the approach I have taken to my independent assessment.

21. First, I am not aware of any undisputed standards for defining rapid transit or for measuring frequency, speed, reliability or capacity, which are the four criteria in the NPS-UD definition of a rapid transit service.

22. There are common benchmarks and better or worse ways of measuring these characteristics. But there are no widely-agreed standards or metrics. For example, there is no consensus over the right metric for measuring reliability or the reliability standard required for rapid transit. Rapid transit is not a tightly defined concept within transport policy.

23. Second, I understand that existing policy documents do not settle the question of whether the Johnsonville line (henceforth, JVL) should be classified as a rapid transit service.

24. The GWRC Regional Land Transport Plan (RLTP) describes JVL as rapid transit.[1] However on my reading of the RLTP this is based on a misunderstanding of the Waka Kotahi/NZTA One Network Framework (ONF), discussed below. No other justification is provided in the RLTP. The RLTP contains no assessment of the line against NPS-UD criteria.

25. The ONF classifies transport corridors. It expands an existing road classification scheme to include rail infrastructure. An early discussion document circulated during the preparation of this framework classified metro rail corridors, regardless of service level, as category PT1. The description of this category included the words 'rapid transit'.[2]

26. Both GWRC and WCC have cited the ONF in support of classifying JVL as rapid transit.[3]

27. In my view there are two reasons the ONF has no bearing on NPS-UD rapid transit classification:

    (a) The ONF does not classify public transport services, only corridors. The NPS-UD by contrast is focussed on rapid transit 'services' and the characteristics of those services. Corridors and services are not equivalent: indeed ONF supporting materials make explicit the need to distinguish between these.[4]

    (b) Since ONF classification of "all metro rail" as PT1 in the early discussion document cited by GWRC and WCC does not depend on performance against the NPS-UD criteria, it cannot be used to determine which rail services are rapid transit in a manner consistent with the NPS-UD's approach.

[1] GWRC (2021) Regional Land Transport Plan, p129.

[2] Waka Kotahi One Network Framework: Movement and Place Classification: Network Classification Factors and Measures, p10 (undated, accessed from Waka Kotahi's website in June 2021). This document includes a disclaimer on p1 "The concepts outlined in this document are to undergo trials with a representative group of Road Controlling Authorities and may be changed based on the results of those trials and other feedback received".

[3] GWRC (2021) Regional Land Transport Plan, p129, WCC (2022) PDP s32 Report Part 1, p46 and WCC (2023), Hearing Stream 1 – s42A Report, 20 January 2023 at [154]-[157].

[4] Waka Kotahi One Network Framework (ONF) Detailed Design, 17 November 2022, p44. The document states that "a distinction needs to be made between a PT service and PT use of a corridor. A PT service has attributes such as frequency (services per hour) and headway (the time between vehicles), and service start and end points, that don't necessarily apply to the corridor".

28. In any event, the current version of the ONF classification guidance (November 2022) no longer classifies all metro rail as PT1 or rapid transit, and Waka Kotahi/NZTA has issued classification guidance that describes JVL as PT4, not PT1.[5] Council officers' advice in the section 42A report that the ONF classifies all metro rail as PT1 is based on an outdated (March 2021) version.[6]

29. On my reading the ONF has no necessary connection to the NPS-UD, but has added confusion to the consideration of the NPS-UD by the Council by assuming such a role and by issuing guidance with potential to mislead decision-makers.

30. For instance, the recent (November 2022) ONF classification guidance:

    (a) advises users that services meeting NPS-UD rapid transit standards should be classified PT1, even though ONF PT1 standards may well differ from rapid transit standards;

    (b) claims the Hutt and Kapiti lines are PT1 because they provide a frequent service on a dedicated corridor "and have been classified as such in the NPS-UD".[7]

31. This second point appears misleading in that the NPS-UD itself does not classify individual services. If the reference is actually to the GWRC RLTP, rather than the NPS-UD, then it assumes the RLTP has a role in NPS-UD rapid transit classification. It is not obvious to me that the RLTP has that role. Further, if the current ONF guidance is relying on a statement in the GWRC RLTP to define rapid transit services, when that RLTP statement is in turn based solely on an earlier and superceded version of the ONF, then the logic is rather circular.

32. Third, therefore, I do not see that Council can reach a view about rapid transit classification for JVL by process or definition alone. There exists no agreed standard or document capable of determining whether a service is a rapid transit service.

[5] ONF Quick Reference Tables, 3 November 2022; ONF Classification Guidance, 17 November 2022 at p20

[6] WCC (2023), Hearing Stream 1 – s42A Report, 20 January 2023 at [154]-[157].

[7] ONF Classification Guidance, 17 November 2022 at p20.

33. My assumption therefore is that the Panel will interpret the NPS-UD definition and form a view about whether JVL is a rapid transit service in light of an assessment of the qualities of the service.

34. My assessment of JVL against the rapid transit criteria is offered in that context.

35. I also presume that in reaching its view the Panel will wish to consider the purpose of the rapid transit upzoning policy in the NPS-UD, and Council's own objectives.

36. My understanding of the purpose of the NPS-UD policy is to encourage housing densification in areas well-served by public transport, in order to enable city growth without the downsides of car dependence, i.e. inefficient people movement, congestion, and long travel times. I refer to Objectives 1 and 3 of the NPS-UD, which say relevantly:

    (a) Objective 1: New Zealand has well-functioning urban environments that enable all people and communities to provide for their social, economic, and cultural wellbeing, and for their health and safety, now and into the future.

    (b) Objective 3: Regional policy statements and district plans enable more people to live in, and more businesses and community services to be located in, areas of an urban environment in which … (b) the area is well-serviced by existing or planned public transport.

37. My assessment of the consequences of classifying JVL as rapid transit and how well those purposes are served is offered in that context.

ASSESSMENT OF THE JOHNSONVILLE LINE AT PRESENT

38. My assessment is based on the four criteria in the NPS-UD definition.

39. I conclude that JVL cannot sensibly be considered frequent, quick or high-capacity, and that whether JVL is adequately reliable is questionable.

40. In my view, all criteria should be met for a service to qualify as rapid transit. Any significant failure against one criteria will reduce patronage regardless of performance against the others.

41. Overall, I conclude the Johnsonville line is not a rapid transit service for the purposes of the NPS-UD.

Frequent

42. Of the four NPS-UD criteria, service frequency has the best-established benchmarks.

43. I consider first the benchmark for 'turn up and go' services, and second the Auckland Transport rapid transit frequency criteria.

'Turn up and go'

44. Turn up and go public transport services provide a step-change in quality of service, because there is no need for timetables or trip scheduling, and perceived reliability is improved since there are no time costs to late running. A turn up and go service is therefore significantly more attractive to consumers.

45. Turn up and go frequency is often cited in descriptions of rapid transit, metro-style, or high-frequency services.[8] I consider it the most sensible benchmark for assessing 'frequency' for NPS-UD rapid transit purposes.

46. A 10 minute frequency is the benchmark most often cited in the transport policy literature for turn up and go, and has some empirical support as a threshold for behaviour change.[9]

47. It is used by Auckland Transport in its Rapid Transit Baseline, which says that "rapid transit services… operate at frequencies that enable users to 'turn up and go' at most times of day, seven days a week" and that "a true 'turn up and go' frequency would be a minimum of every 10 minutes".[10]

[8] For comment and plans explicitly linking rapid transit with turn-up-and-go frequency see, for example: Greater Auckland, Commuter rail or rapid transit?, 19 June 2012; Auckland Transport Rapid Transit Baseline, 2021; Greater Christchurch Partnership, Mass Rapid Transit, undated, accessed 1 Feb 2023; WA Department of Transport, Perth and Peel Transport Plan, undated, accessed 1 Feb 2023.

[9] Currie et al. (2013), Experience with value for money urban public transport enhancement, (NZTA research report 531), at section 4.3.2; Clifton (2021), The use of smart card data to analyse railway station waiting times, *The Routledge Handbook of Public Transport*.

[10] Auckland Transport (2021), Rapid Transit Baseline Working Doc, p9.

48. It is used by Let's Get Wellington Moving (LGWM) in describing mass rapid transit as running "at least every 10 minutes, and more often during peak times".[11]

49. It is also used in marketing: in Melbourne, for instance, buses and trains marketed as turn up and go are only those with 10 minute or better frequencies throughout the day.

50. A 10 minute frequency is the bare minimum for true turn up and go as it implies an average 5 minute wait time. If the average wait time is any longer then it becomes a significant portion of shorter trips (e.g. 20-30 minutes).

51. Metro systems overseas generally run at 5 minutes or better during peak times. Even heavy rail services in Melbourne and Sydney achieve this.

Auckland Transport rapid transit definition

52. Auckland Transport used a threshold of 15 minute frequency between 7:00am-7:00pm, 7 days a week for its rapid transit assessment, while noting that a true turn up and go frequency is 10 minutes.[12]

53. In my view it is reasonable to apply no less stringent a criterion to Wellington, where car travel is quicker and a mediocre rail service will not attract high mode share.

Johnsonville service – assessment of frequency

54. JVL has 15 minute frequency at peak times, 30 minutes off-peak and at weekends, and 60 minutes early and late at night.

55. This clearly falls short of the 10 minute standard for 'turn up and go' services. It also fails to meet the Auckland Transport criteria, as the 15 minute frequency is not sustained between 7:00am and 7:00pm.

56. To appreciate the materiality of JVL's departure from these rapid transit standards, it is useful to explain how frequency affects patronage – this is called the 'service elasticity':

[11] LGWM (2021), Mass Rapid Transit Consultation FAQs.

[12] Auckland Transport (2021), Rapid Transit Baseline Working Doc, p9

(a) Studies measuring service elasticity suggest that doubling frequency leads to two-thirds more patronage in the long run, with off-peak impacts generally twice as large as this.[13]

(b) JVL falls short of 10 minute frequencies by 50% in the peak and 200%+ in the off-peak, so with turn up and go frequencies JVL would have around one-third more peak patronage and two to three times more off-peak patronage than at present.

(c) JVL falls short of 15 minute frequencies by 100% in the off-peak, so with Auckland Transport's criteria met JVL would have off-peak patronage about twice current levels.

57. In summary, I cannot see that on any accepted benchmark the JVL service can be described as 'frequent' for rapid transit purposes. JVL's relative infrequency has a material impact on its attractiveness to travellers, on patronage, and therefore on its potential to support future population growth.

Quick

58. The only appropriate way to assess the adequacy of service speed is relative to alternative transport options, taking into account patterns of transport demand (i.e. trip origins, destinations, and timing).

59. There are no clear benchmarks for service speed as there are for service frequency — it is a matter of local context and judgement.

60. Auckland Transport's definition of a rapid transit service as offering "time-competitive travel with private vehicles, particularly at peak times" is appropriate in my view.[14]

61. To assess this quantitively, one would ideally measure average time savings for line users relative to driving using a transport model. Since transport modelling is a resource-intensive exercise, an acceptable shorthand approach is to make rail versus car comparisons for representative trips using

[13] Currie et al. (2013), Experience with value for money urban public transport enhancement, NZTA research report 531, section 5.3.2; Kennedy (2013), Econometric models for public transport forecasting, NZTA research report 518, section 4.4.

[14] Auckland Transport (2021), Rapid Transit Baseline Working Doc, p9

Google maps or similar. A Google maps based approach is utilised in the section 42A report before the hearings panel.[15]

62. I have also seen analysis of this type in the submission by Lawrence Collingbourne et al.[16]

63. I have not replicated Collingbourne et al's analysis since I would have used similar methods and the broad outcomes are not disputed in the Council's section 42A officers' report:[17]

    (a) JVL is time-competitive for a narrow subset of trips: trips at peak time for commuters travelling between the closest few stations on the line (Crofton Downs, Ngaio and Awarua Street) and destinations near Wellington station;

    (b) For other JVL line stations, all trips outside peak, and all destinations other than those near Wellington station, car and sometimes bus travel is faster.

64. To interpret these findings as part of an overall assessment I add three points.

65. First, walk and wait time from the true trip origin (i.e. home) is an important part of the equation. It seems neither WCC s 42A officers' analysis nor Collingbourne et al consider this. Walk and wait time likely adds an average 10 minutes to each JVL line trip, but not to driving.

66. Second, only a small minority of trips fall within the narrow subset Collingbourne et al found were time-competitive with driving:

    (a) A significant share of trips from the JVL catchment are to destinations far from Wellington station. Around two-thirds of trips to work, a proxy for peak hour trips, are to a very widely drawn walking catchment around Wellington station. This catchment extends from Te Papa to Hutt Road, and is far broader than a true walking catchment, which likely makes for

[15] WCC (2023), Hearing Stream 1 – s42A Report, 20 January 2023 at [181].

[16] WCC (2023), Hearing Stream 1 – s42A Report Appendix D – Review of the designation of the Johnsonville Railway Line as a rapid transit system by Lawrence Collingbourne, Tony Randle and Julie Ward at p14–15.

[17] WCC (2023), Hearing Stream 1 – s42A Report, 20 January 2023 at [182]-[183].

a significant overestimate of the share of trips with destinations convenient to Wellington station. I use this broad catchment because the most readily available Stats NZ data is at a relatively large geographic scale. Around 10% of work trips are to the broader CBD, and around one-quarter of work trips from the JVL catchment being to other destinations entirely.[18]

(b) I expect the share of non-work trips to the Wellington station catchment to be much lower than the share of work trips, given the predominance of office space in the station catchment.

(c) Only a minority of JVL catchment trips originate from the suburbs of Ngaio or Crofton Downs (for work trips, around 30%).

(d) The work trip share of all trips, a proxy for trips that must occur at peak time, is relatively low (around 20%).[19]

67. Third, commute patterns suggest that even where the JVL line is most time-competitive, the comparable speed is outweighed by other disadvantages:

(a) Only one-third of work trips from the suburbs of Ngaio and Crofton Downs to the Wellington station catchment are by train.

(b) Twice as many trips on this route (two-thirds) are by car, bus or active travel.[20]

68. To summarise: the subset of trips from the JVL catchment where the JVL service is time-competitive is small — perhaps 5-10% of all trips — and even where it is most competitive commuters are at present twice as likely to choose alternatives, indicating that the JVL service is not adequately quick to offset the other disadvantages of rail travel and attract high mode share.[21]

[18] Data is from Census 2018. JVL catchment figures sum all Johnsonville, Khandallah, Onslow, Ngaio and Crofton Downs SA2s. The Wellington station catchment includes Wellington Central, Thorndon, and Pipitea-Kaiwharawhara SA2s so as to capture virtually all downtown office space.

[19] Household Travel Survey, Mode and purpose travel by residents 2015 onwards, work trip share x2 (out plus return), NZ average. Census data does not describe non-work trips other than for education (~3% of trips).

[20] Data is from Census 2018.

[21] The indicative 5-10% figure is based on multiplying the work trip share of all trips as a proxy for peak trips (20%), the Ngaio/Crofton Downs share of JVL catchment work trips (30%), and the

69. Though there are no clear benchmarks, this does not suggest the JVL service is 'quick', other than for a relative minority of travellers.

Reliable

70. There exist various reliability metrics for road travel and public transport services. But these are not readily comparable, estimating them is data intensive, and there exist no standards for when a rail service is reliable enough to be deemed rapid transit.

71. I therefore offer no strong view on whether JVL is reliable for NPS-UD purposes. This is not essential for my overall assessment.

72. I note however that WCC staff and Collingbourne et al seem to agree there are reliability issues with JVL. Issues include:

    (a) Punctuality pre-COVID at around 96.5%, meaning that twice per month a regular passenger can expect their train to depart more than 5 minutes late.[22]

    (b) Reliability on JVL at 93%, meaning 1 in 14 services do not run as scheduled.[23]

    (c) The high number of replacement buses. Figures for JVL are not publicly available, but currently 1 in 6 rail services across the GWRC network are replaced by buses.[24]

73. I agree that these sorts of issues negatively impact on service reliability.

High-capacity

74. There are no clear standards for rapid transit capacity.

75. WCC cite the ONF PT1 benchmark as a threshold for high-capacity. By contrast, Auckland Transport's Rapid Transit Baseline has no explicit metrics, although it notes that "compared to the capacity of a single lane of traffic

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Wellington station destination share of work trips (68%), rounded up for non-work trips occurring at peak.

[22] GWRC (2020), Wellington Metropolitan Rail 2019/20 Annual Report. Punctuality has deteriorated and in 2022/23 is at 89%, i.e. 1 in 10 services depart more than 5 minutes late.

[23] Metlink Monthly Performance Report, November 2022.

[24] Metlink Monthly Performance Report, November 2022.

(800-2,000 vehicles per hour), rapid transit offers the potential to move vastly more people".

76. In my view, whether JVL should be deemed high-capacity for NPS-UD purposes depends on the task expected of it, namely whether capacity at peak times can accommodate additional demand resulting from population growth and changing travel patterns.

77. I first comment on using the ONF people movement threshold to judge capacity, then I provide estimates of future JVL demand relative to capacity.

WCC assessment of capacity: ONF people movement thresholds

78. WCC uses the indicative PT1 bi-directional people movement threshold of >3,000 per day from an early discussion document version of the ONF as a benchmark for high capacity.[25]

79. This is a flawed approach: the PT1 threshold is far too low to define high capacity. The finalised ONF actually uses a threshold of >1,000 per day.[26] Earlier drafts used >5,000 and >3,000.[27]

80. PT1 in the latest ONF has a people movement threshold of >1,000 people per day, which is similar to low-level general traffic road classes, namely:

    (a) GT6 – Secondary Collector (>1,200) and

    (b) GT7 – Access road (>1,200).

81. Examples of GT6 – Secondary Collector roads include:[28]

    (a) Shelley Bay Road, Shelley Bay

    (b) Devon St, Aro Valley

[25] Waka Kotahi/NZTA (2021), ONF Movement and Place Network Classification Detailed Design, March 2021, cited in WCC (2023), Hearing Stream 1 – s42A Report, 20 Jan 2023 at [154]-[157].

[26] Waka Kotahi/NZTA (2022), ONF quick reference tables, 3 November.

[27] >5000 is from Waka Kotahi/NZTA (2020), Movement and Place Classification Network Classification Factors and Measures, September 2020. >3000 is from Waka Kotahi/NZTA (2021), ONF Movement and Place Network Classification Detailed Design, March 2021.

[28] WCC (2021), Road Classification – Draft District Plan (DDP)

82. Examples of GT7 – Access roads include:

(a) Old Porirua Road (beside Ngaio Gorge road)

(b) Lookout Road, Mt Victoria

83. The PT1 threshold has capacity equivalent to that provided by a single lane road. This cannot be considered 'high'. As noted, Auckland Transport's conception of rapid transit is precisely the opposite — that rapid transit should move vastly more people than can a single lane road.

84. Capacity on JVL is broadly on par with ONF road class GT4 – Arterial road. JVL can move at most 2,000 passengers per hour, or 8,000 over the four peak hours in which most travel occurs. GT4 – Arterial roads move 6,000 to 18,000 people per day.

85. Examples of GT4 – Arterial roads include:

(a) Oriental/Evans Bay Parade to Evans Bay

(b) Chaytor St to Karori

86. These examples are useful benchmarks for JVL capacity. As with these roads, capacity on JVL cannot easily be increased. Whether capacity is adequate to support population growth therefore depends on current spare capacity relative to projected additional demand.

Does the Johnsonville line have capacity to support future demand?

87. To assess this I use population growth and JVL patronage projections under several mode switch scenarios to estimate future demand relative to capacity. Full details of my analysis are in Appendix A.

88. I first outline my assumptions and inputs, and then explain my findings.

89. Population growth is based on projections for Wellington City by Sense Partners, apportioned by the JVL catchment share of Wellington City's total realisable development capacity.[29] In other words, I assume that the JVL

[29] Sense Partners projections are from the Wellington Housing and Business Capacity Assessment (HBA), Chapter 2, Table 2.3. The JVL share of realisable capacity is based on this HBA.

catchment would see population growth proportional to the realisable development capacity it provides as a share of the city-wide total.

90. Zoned capacity for population growth is mostly due to the new Medium Density Residential Standards (MDRS). Further NPS-UD upzoning based on a rapid transit service classification would have only a small impact on development capacity. For this reason I use a single population scenario for both zoning scenarios.[30]

91. Projected JVL catchment population growth from the current 29,000 residents is around 4,000 residents to 2031 (+14% on 2021) and around 11,000 residents to 2051 (+38% on 2021). See Table 4, rows 9-13.

92. I use two measures of patronage to assess current spare capacity and measure future demand:

    (a) Peak service patronage – the busiest single service in the busiest month; and

    (b) Peak hour patronage – patronage in the busiest weekday hour, averaged over the busiest month.

93. The choice of patronage measure entails a tradeoff between identifying demand peaks and representing average conditions. Broadly, when peak service patronage hits capacity there will be one service in the busiest month that some passengers cannot board, and when peak hour patronage hits capacity some passengers will be unable to board around half the peak-hour trains that month, with knock-on effects on timely running. These two measures bookend the range between a minor and a major reduction in perceived service quality.

94. Peak service patronage on JVL hit 362 in May 2021, or 74% of single service capacity of 492 per train. Peak hour patronage across the month was 925, or 47% of peak hour capacity of 1,968 per hour.[31]

[30] The Draft District Plan (DDP) capacity assessment, based on MDRS and NPS-UD upzoning, modelled realisable capacity in the JVL catchment rising by 500% from around 3,000 dwellings to 20,000 dwellings (Property Economics, June 2022). This decreased by only 1,000 dwellings from DDP to PDP upon removal of JVL catchment NPS-UD upzoning (Property Economics, Nov 2022).

[31] Capacity as per WCC (2022) PDP s32 Report Part 1, p47. May 2021 JVL patronage data by service and day sourced from WCC email from Andrew Wharton to Lawrence Collingbourne, dated 20 August 2021.

95. May 2021 patronage was 30% down on the equivalent month prior to COVID (May 2019).[32] I assume for patronage projections that this step-down is permanent, i.e. the starting point for growth is patronage as at May 2021.

96. In the baseline mode share scenario I assume mode share and trip timing remain unchanged. JVL peak service and peak hour patronage therefore rise in proportion with population growth, as does road use.

97. A zero mode-switch scenario is highly unrealistic. As local road networks reach capacity, congestion will encourage car and bus users to switch to rail and/or change trip timing. An increase of 14% in peak-hour road use by 2031 is likely to cause serious congestion, since small increases in traffic volumes have disproportionate impacts on travel speed when roads are close to capacity.

98. To illustrate this last point I offer two examples:

    (a) SH1 (Ngauranga Gorge) and Terrace Tunnel AM peak traffic volumes rose between 2002 and 2016 by 8% and 15% respectively. However AM peak congestion measured by NZTA on selected Wellington SH routes over an even shorter period, 2008 to 2014, rose by a much larger amount, 38%.[33]

    (b) After a freight train derailment cancelled all rail services on 3 July 2019, additional morning vehicle traffic rose by around 9% and vehicle travel times approximately doubled.[34]

99. I therefore consider two mode-switch scenarios:

    (a) All new peak trips to the Wellington station catchment are by rail, which effectively assumes that all spare local road capacity is absorbed by new peak trips to other destinations (mode switch scenario 1).

    (b) Growth in peak trips by car or bus to all destinations is capped at 10%, with excess trips switching to rail, in reality by way of

[32] May 2019 patronage from GWRC, Bus Rail data by month Jul 2018 to Oct 2020, GWRC OIA response 10 December 2020.

[33] LGWM data report, Table 5 and section 4.6.1.

[34] GWRC (2022) Wellington Rail Programme Business Case, p36

both new and existing trips to the Wellington catchment moving to rail and trips to elsewhere remaining by car/bus (mode switch scenario 2).[35]

100. These are necessarily somewhat crude behavioural assumptions. Transport modelling with flexible trip timing, mode, and route choices could provide more reliable estimates. However in the absence of model-based forecasts by WCC or GWRC of the transport network impacts of upzoning and population growth for the JVL catchment, or for Wellington as a whole, even these rough approximations are useful.

101. I turn now to the outcomes of my assessment based on the inputs and assumptions just described. The corresponding analysis is detailed in Table 4 and presented in Chart 3 of Appendix A.

102. Without mode switching, projected population growth poses no immediate problem for JVL capacity. Population and patronage growth of 14% to 2031 leaves estimated patronage below pre-COVID levels (Table 4, rows 14-27).

103. However, with more realistic mode switch to rail, peak service capacity is breached between 2028 and 2032 (Table 4, rows 34, 48). By 2031, peak hour patronage is one-third to one-half higher than current levels, and peak hour road use is up 5% to 10% (Table 4, rows 41, 55). Peak hour patronage breaches JVL capacity by 2045 (Table 4, rows 40, 54).

104. A number of caveats apply to these estimates, which are conservative in several respects:

(a) Perceived service quality declines well before services hit capacity. WCC's capacity measure is based on 2.55 standing passengers per sqm standing space, which is 35% more standing passengers than GWRC's consultant, Stantec, defines as the "maximum comfortable" standing capacity in the Wellington Rail Programme Business Case.[36]

[35] In estimating these scenarios the modal and destination distribution of work trips is used as a proxy for the distribution of peak trips for all purposes, which is what matters for road and rail capacity. Census mode and destination data exists only for work and education trips. Work trips are a reasonable proxy, since most work trips are at peak and have less flexible timing.

[36] Stantec, Appendix D to GWRC (2022) Wellington Rail Programme Business Case, p7. Stantec's maximum comfortable capacity is 1.5 passengers per seat or 147 standing per 294 seated (441

(b) This means pressure for rail passengers to switch to cars, and for road and rail users to adjust trip timing, may therefore occur well before 2031. Adaptive responses to crowding on trains and congestion on roads will determine the balance of these outcomes.

(c) Under Stantec's maximum comfortable capacity definition, capacity on JVL is 441 per train (10% less than WCC's figure). On this measure, peak service patronage breaches capacity between 2026 and 2030 (Table 4, rows 34, 48) and peak hour patronage breaches capacity by 2038 to 2041 (Table 4, rows 40, 54).

(d) All estimates assume the step-down in patronage from pre-COVID levels, 30% for JVL, is permanent.[37] If it reverses, both peak service capacity and peak hour capacity will in my estimates be breached by 2031. My assumption is more conservative than applied in the Wellington Rail Programme Business Case, which effectively justifies the case for investment on an assumed bounce-back in patronage across the network.[38]

105. In summary, projected population growth in the context of capacity-constrained local roads and mode shift means:

(a) JVL's peak service capacity is expected to be exceeded within 5-10 years, with material declines in service quality; and

(b) JVL is expected to be over-run (i.e. peak hour patronage exceeded) within 20 years; and

total), vs WCC's 198 standing per 294 seated (492 total). Stantec's economic analyst when forecasting demand (Appendix K) also assumes lower capacity than WCC.

[37] Across all GWRC rail, patronage in the base month for projections (May 2021) was down 22% on the same month in 2019 (Metlink Patronage Statistics, November 2022). JVL was down 30% (see paragraph 95). As at November 2022, GWRC rail remained down from November 2019 by 22%, i.e. the May 2019 to May 2021 drop has persisted. For the purposes of patronage projections, the 30% step change downwards from 2019 to 2021 on JVL was therefore assumed to be permanent. If it is temporary, spare capacity will be consumed faster than projected.

[38] GWRC's consultants assume patronage growth pauses 2019 to 2022 before growing again from 2019 levels (Wellington Rail Programme Business Case, p78). A -10% enduring effect is assumed as a sensitivity test but the main benefit/cost results are based on full recovery (Appendix K p3).

(c) across this 5–20 year period, local roads will also become significantly more congested.

106. The Wellington Rail Programme Business Case provides evidence of how crowding and unreliability affect passenger satisfaction and mode choice. It notes that "a clear decline [in satisfaction] is evident over the 2016 to 2019 period, which only reversed with COVID-19, when patronage and crowding reduced". It also argues that road and rail patronage data "clearly demonstrates that if a potential passenger wants to shift the time of their travel [when the rail network is unable to accommodate additional users], they will use other modes if rail services are not as convenient at the new travel times".[39]

107. The balance of evidence suggests to me that JVL lacks capacity to support projected population growth. No meaningful proportion of the travel demands of an expected 11,000 new residents by 2051 can be met by a service with current peak-hour spare capacity of at most 1,000 passengers.

108. Claims that JVL capacity will not be breached despite line capacity being small relative to population growth effectively amount to claims that local roads are up to the task of moving many more people without significant loss of function. As best I can see, there are no model estimates supporting that claim, and several reasons to doubt it will hold true.

109. While projected population growth is not due to NPS-UD upzoning, but to the MDRS, the latter means that no capacity remains on JVL to support the further growth that would be enabled by NPS-UD upzoning.

110. On this basis, and on the basis that JVL capacity is broadly equivalent to that of a single-lane road, I do not consider JVL can be treated as a high-capacity service for NPS-UD purposes.

JOHNSONVILLE LINE IN THE FUTURE

111. The NPS-UD building height provisions apply around not only existing but also planned rapid transit services.

[39] GWRC (2022) Wellington Rail Programme Business Case, p23-24.

112. Based on my reading of the NPS-UD, RLTP, and Wellington Rail Programme Business Case I see no evidence that JVL can be deemed 'planned rapid transit'.

113. The 2021 GWRC RLTP contains no plans to change the frequency, speed, reliability or capacity of the line.

114. The 2022 GWRC Wellington Rail Programme Business Case also has no concrete plans to improve the line. Frequency and capacity improvements in the preferred programme are discussed almost exclusively for the Hutt and Kāpiti lines, and improving the JVL track configuration to improve capacity is given an anticipated physical works start date of 30+ years. The only action identified for JVL in the near term (0-5 years) is a "study" on the use of existing lines, also described as a review of the role of JVL as heavy rail to enable better efficiency at Wellington Station in advance of converting the line to light rail (30+ years).[40]

115. Looking beyond these documents, it appears unlikely to me that JVL will be significantly improved to change its frequency, speed, reliability or capacity within any meaningful timeframe.

116. I base this on my review of rail business cases and GWRC advice and on my understanding of the economics of funding processes, rather than any knowledge of the technical (engineering) requirements to improve the JVL line.

117. In particular I observe that:

    (a) GWRC have advised that JVL at present cannot accommodate trains longer than 4 cars, and that significant operational planning and infrastructure changes would need to occur in order to accommodate a larger train.[41]

    (b) The preferred programme in the Rail Programme Business Case ('Drive Mode Switch') was the most ambitious (highest cost) of all packages considered. There were no JVL interventions

[40] GWRC (2022) Wellington Rail Programme Business Case, Preferred Programme in pp.viii-xii, Appendix H, and Appendix J. Without further details the business case also lists crossovers, power supply upgrades, and level crossing removals as possible actions for JVL.

[41] Pareesha Mehta-Wilson (GWRC) LGOIMA request response to Julie Ward, 9 November 2020.

identified in other packages that might be brought forward if funded.

(c) The precursor to this business case, the 2013 Regional Rail Plan, identified only minor changes to JVL as worthy of consideration.[42]

(d) GWRC funding proposals and Waka Kotahi/NZTA funding decisions are generally based on investment merits expressed in benefit/cost terms. The low benefit/cost ratios for shortlisted programmes in the Wellington Rail Programme Business Case and its predecessor, the Regional Rail Plan, suggest that potential JVL line interventions not identified in these documents are unlikely to have benefit/cost ratios adequate to be funded by central or local government.[43]

118. An additional factor weighing against significantly expanding JVL services is the high net operating cost of the line relative to other rail lines and bus services:

(a) The operating cost per passenger kilometre is around 3 times higher than on other lines. Operating cost recovery through fares runs at around 20%, compared to an average 35% across all GWRC lines.[44]

(b) WCC area buses run at around 90% cost recovery. Should additional public transport capacity be needed for the JVL catchment, prioritising bus services will appear the preferred solution given GWRC's limited budget.

119. In summary, I do not think JVL qualifies as planned rapid transit or, on the basis of the investment case and cost information I have seen, is ever likely to be upgraded to meet rapid transit standards.

[42] GWRC (2013) Wellington Regional Rail Plan, p83

[43] The Wellington Rail Programme Business Case preferred programme has BCR range 1.1-1.5 (sensitivity test range 0.9-1.8), which the document acknowledges is low (p78). The Regional Rail Plan shortlisted packages had BCRs in the range 0.9-1.4.

[44] GWRC Bus and Rail Patronage, Revenue and Costing Analysis, 3 Sep 2012, slides 6, 13, 14.

CONSEQUENCES OF CLASSIFYING THE JOHNSONVILLE LINE RAPID TRANSIT

120. The following sections of my evidence discuss how well the NPS-UD objectives would be served by classifying JVL as rapid transit. They consider whether further upzoning would improve housing affordability, promote a compact city with lower car use, and use transport networks efficiently.

121. Overall, I expect that upzoning around JVL will reduce citywide housing density, reduce active and public transport mode share, increase car dependency, worsen the performance of the transport network, and not improve housing affordability across Wellington as a whole.

Housing supply and affordability

122. Further upzoning of the JVL catchment beyond the MDRS zoning will not lead to more housing development in Wellington and will therefore not affect city-wide housing supply or housing affordability.

123. This is because zoning influences where new housing goes, and what it looks like, but not how much is built in aggregate – except under highly restrictive zoning conditions that do not currently apply in Wellington.

124. The rate of new housing supply is a private sector decision subject to private incentives. This means ample zoned land is necessary but not sufficient for development. Zoning can shape built form, and manage infrastructure demands, but can not force more housing to be built.

125. In Wellington, as in many cities in New Zealand, Australia and elsewhere, the rate of new supply is effectively constrained by construction sector capacity and private profit incentives, but not by zoning rules. In Wellington this is observed in practice in excess zoned capacity and high development feasibility.

126. Around 1,000 dwellings are built each year in Wellington. Under the operative district plan more than 100,000 additional dwellings could be built on sites already zoned for housing. Around 35,000 could be built on sites zoned and

already feasible (profitable) to develop.[45] Developers could build more than they do and still make a profit, but they choose not to.

127. Although the economics of housing development and new housing supply is a relatively new field, a growing body of theory and evidence supports the view that the rate of new supply is determined by the relative profitability of land-banking (speculation) versus developing.[46] That is, commercial incentives set the speed limit on new supply whenever regulatory limits are non-binding, as in Wellington. Zoning only alters built form and the sequence of sites brought to market. Economists have no other coherent theory of new supply.

128. Because of this, I expect upzoning around the JVL line to:

    (a) Make no difference to city-wide new housing supply;

    (b) Increase development in the JVL catchment area;

    (c) Result in JVL catchment development being at higher density than otherwise; and

    (d) Reduce development across the remainder of the city, leaving more vacant lots and run-down houses undeveloped, including in areas better served by active and public transport connections than the JVL corridor.

129. I expect these consequences to occur regardless of rapid transit classification as a result of the MDRS upzoning, but to be exacerbated by NPS-UD upzoning should JVL be classified as rapid transit.

130. This is an important point for the Panel in considering whether rapid transit classification supports the NPS-UD objectives. A key question is not whether more housing is better than less, but whether more housing along the JVL line is better than more housing elsewhere.

[45] Wellington City commercially feasible residential capacity assessment, Appendix 2.2 to May 2022 HBA (Property Economics, October 2021).

[46] Letwin (2018), Independent Review of Build Out Rates; Murray (2020), Time is money: How landbanking constrains housing supply, Journal of Housing Economics; Murray (2021), A Housing Supply Absorption Rate Equation, The Journal of Real Estate Finance and Economics; Murray (2021), The Australian housing supply myth, Australian Planner; Huang et al. (2015), Is insufficient land supply the root cause of housing shortage?, Habitat International.

Compact city and mode switch objectives

131. More housing around the JVL line at the expense of elsewhere appears counterproductive to the goals of a compact city with lower private vehicle use.

132. Census data shows around 60% of work trips from the JVL catchment are by car and 40% by walking, cycling or public transport (Appendix A, Table 1 and Chart 1). For the rest of Wellington, the ratios are reversed. All suburbs in the JVL catchment have higher car travel mode share than Wellington as a whole (Appendix A, Table 1 and Chart 2).

133. I see no reason why new residents would use the JVL service more than existing residents, except insofar as all future residents may switch away from increasingly-congested roads. Displacing housing to the JVL catchment via NPS-UD upzoning will therefore worsen overall car dependence.

134. In the areas identified by the HBA as having most potential for development, car use is even lower than the Wellington average. Comparing the JVL catchment to these areas, weighting mode share by realisable development capacity, I estimate that for every 100 additional work trips generated by population growth along the JVL line, 24 more will be by car (that is 24 fewer by active or public transport) than if the growth occurred elsewhere (Appendix A, Table 2 at bottom).

Transport network efficiency

135. As explained in paragraphs 97–98 above, even minor population growth along the JVL line could cause significant deterioration in the performance of the local road network, resulting in longer travel times for car and bus passengers.

136. To reliably estimate the impact of this on road performance would require transport modelling, as noted. My view that projected population growth of 14% by 2031 could cause significant congestion is based on a range of contextual factors, including the:

    (a) current low mode share of rail;

    (b) limited spare line capacity, as discussed in paragraphs 101-105;

(c) current dominance of car travel;

(d) limited spare road capacity at peak times;

(e) hilly topography of the area;

(f) relatively long distance to the CBD;

(g) poor walkability to most destinations;

(h) narrow street widths along the bus routes;

(i) existing on-street parking demand;

(j) NPS-UD prohibition on off-street parking requirements; and

(k) geographical constraints on major routes.

137. If JVL sees sizeable growth in mode share and patronage absent any improvement in service quality, it will signal that road network performance has deteriorated significantly. If it does not, because local roads have the capacity to move significantly more people without loss of function, it calls into question the rationale for upzoning on the basis of the rail service, rather than the road links.

RESPONSE TO OFFICERS' SECTION 42A REPORT

138. I have reviewed the rapid transit section of the Council officers' section 42A report (paragraphs 121–206 and Appendix C), and make the following comments in response. Where I do not directly respond to a point, it does not mean that I necessarily agree with it.

139. *Paragraph 152*: I do not agree that the Wellington Regional Growth Framework (WRGF) is relevant to the assessment of whether a service is a rapid transit service. I note that the map in this framework (p44) appears to use a 20 minute service frequency as the benchmark for a rapid transit service. I do not consider this sufficiently frequent to qualify as rapid transit, for reasons explained at paragraphs 42-57 above. I also note that while the WRGF map purports to identify "parts of the rail network that could be considered rapid transit (when higher-frequency services are introduced around 2025, generally increasing service frequency to 10-15 minutes)", there are no frequency improvements for JVL scheduled for 2025 in the RLTP.

140. *Paragraph 153:* I do not agree that the example of Wellington commuter rail lines as rapid transit services provided in the Ministry for the Environment (MfE)'s guidance on implementing the NPS-UD is relevant to the rapid transit assessment for JVL, because MfE's guidance contains no assessment of JVL against the NPS-UD criteria.

141. *Paragraphs 149-150 and 154-157*: for reasons given in paragraphs 24-31 above I do not believe the ONF and RLTP are relevant to the rapid transit assessement of JVL. Amongst these reasons is that WCC officers are relying on an outdated version of the ONF.

142. *Paragraph 159*: based on my assessment of the likely consequences of intensification for the functioning of local roads (paragraphs 135-137 above), I do not agree that enabling six storey building heights via rapid transit classification would support the NPS-UD objective of well-functioning urban environments. As noted, intensification around JVL is likely to increase car dependence, road congestion, and travel times by car and bus.

143. *Paragraph 163*: I agree with officers' assessment that classifying JVL as rapid transit will not affect housing affordability or the competitiveness of land and development markets in Wellington.

144. *Paragraph 172:* I do not agree that enabling high density around JVL would necessarily increase the use of public transport, active transport, and micromobility, nor necessarily support a reduction in greenhouse gas emissions. This is because:

    (a) NZ's transport sector emissions are covered by the binding emissions cap in the Emissions Trading Scheme (ETS). Reductions in emissions by way of mode shift away from cars free up emissions credits for others to purchase, leading to lower emissions costs elsewhere in the economy but no change in total emissions.[47]

    (b) Whether higher density around JVL would increase the use of public transport, active transport and micromobility depends

[47] For an accessible explanation of why Council-level inititiatives targeting emissions already covered by the ETS do not reduce economy-wide emissions see Crampton (2022), Rushing emissions plan a costly mistake, Newsroom, 29 March.

on where new housing would otherwise have gone. As explained in paragraphs 131-134 above, new housing around JVL instead of elsewhere is likely to lead to more, not fewer, residents travelling by car.

145. *Paragraph 175:* I note that WCC officers' suggestion that capacity can be easily increased by adding more carriages conflicts with GWRC's advice that one of the platforms on the Johnsonville line is not long enough for anything more than a four car train, and that significant operational planning and infrastructure changes would need to occur in order to accommodate a larger train (see paragraph 117(a) above).

146. *Paragraph 176 and Appendix C*: I have examined the assumptions in officers' report on the capacity of JVL to support planned potential population growth (Appendix C to the s42A report). Officers conclude that capacity may need to be increased in the 2035-2050 period to support growth. My assessment at paragraphs 101–105 above concludes that JVL capacity is expected to be exceeded within 5–10 years, resulting in material declines in service quality. On my reading, the differences in views about the timeframe for capacity to be breached are mainly due to:

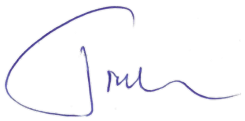
(a) Council officers estimating future patronage by extrapolating from a starting point of patronage on the busiest daily service (8:00am from Johnsonville) averaged over the month of May 2021, while my measure of peak service patronage uses as starting point the busiest single service in that same month (8:00am from Johnsonville on Thursday 27 May 2021). In my view, averaging peak service patronage over a month is inappropriate as starting point to assess capacity, since it masks the material differences in demand for that service that arise over the course of the week and the month. Using the same month of data as WCC officers (May 2021), I calculate that patronage on the busiest service on the busiest weekday (Thursday) is on average 12% higher than for that service across all weekdays of the month, and patronage on the busiest single service is 21% higher than for that service on average across all weekdays of the month. That is, my starting point is 21% higher than Council officers' starting point. The differences between the busiest single service and the busiest service averaged over

a month are material in the context of spare capacity estimates. They mean a weekday service that is 80% full on average across all weekdays of the month will breach capacity at least once per month. This represents a material reduction in service quality. But that reduction in service quality is masked by the use of averages in the Council officers' report.

(b) Council officers' mode switch scenarios assume new residents are 3x more likely to use rail then existing residents. In the context of overall population growth, and the current low mode share of rail, this represents a very small shift in overall patronage by JVL catchment residents. This mode switch scenario implicitly assumes that the the local road network can absorb the large increase in population not using the train without major congestion. In my view, expressed in paragraph 97 above, this is unrealistic. More realistic is that population growth prompts significantly higher demand for the JVL service as roads reach capacity.

147. *Paragraph 177*: I do not agree that the fact that bus services can be expanded supports an argument that the train's capacity is high.

148. *Paragraph 206 "Economic" section*: I do not agree with the claim that more land zoned for apartments will reduce land prices in a way that lowers apartment prices. Causation between house prices and land prices as understood by economists runs the other way around: land prices are determined by the residual by what buyers are willing to pay for built property, minus the costs of development. Council officers' claim in paragraph 206 is also inconsistent with their claim in paragraph 163, which I support, that classifying JVL as rapid transit will not affect housing affordability or the competitiveness of land and development markets.



TIMOTHY WALTER HELM
7 FEBRUARY 2023

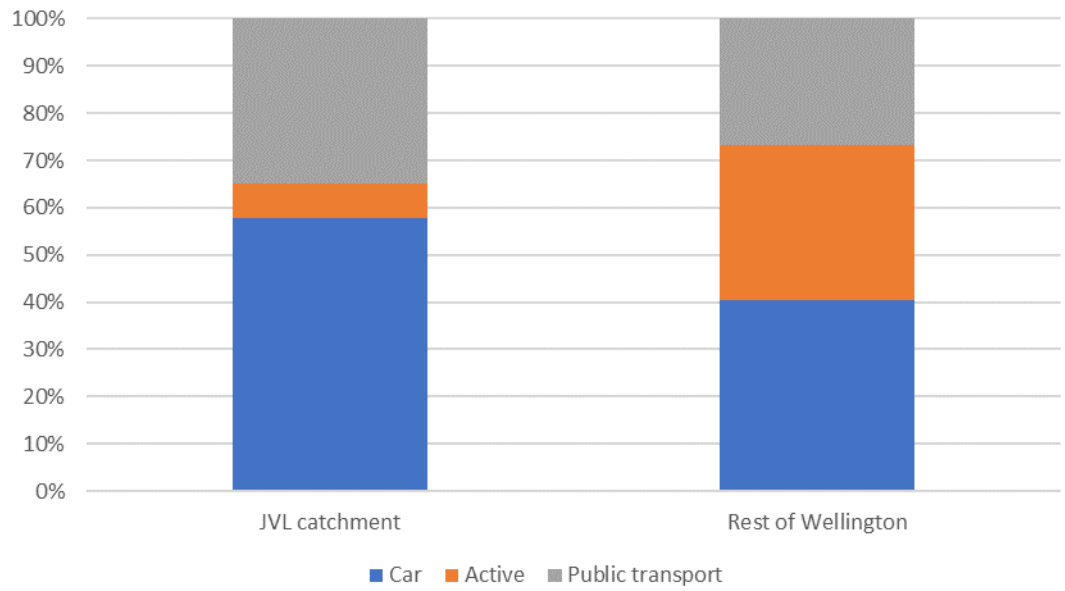
Appendix A: Tables and charts

Table 1: Share of trips to work by mode by SA2, ordered low to high by car share

	Johnsonville (JVL) line catchment					Rest of Wellington			
		Public transport + active					Public transport + active		
Suburb (SA2)	Car	Public transport	Active	PT + active	Suburb (SA2)	Car	Public transport	Active	PT + active
Ngaio North	49%	43%	8%	51%	Wellington Central	2%	3%	95%	98%
Ngaio South	51%	38%	11%	49%	Dixon Street	4%	9%	87%	96%
Johnsonville Central	53%	39%	9%	47%	Wellington Botanic Gardens	4%	0%	96%	96%
Crofton Downs	58%	35%	7%	42%	Courtenay	4%	7%	88%	96%
Johnsonville South	58%	35%	7%	42%	Vivian West	5%	7%	88%	95%
Khandallah North	58%	31%	11%	42%	Wellington University	7%	3%	89%	93%
Khandallah Reserve	60%	36%	4%	40%	Mount Cook East	9%	25%	67%	91%
Johnsonville West	63%	33%	4%	37%	Vivian East	9%	13%	78%	91%
Khandallah South	63%	29%	9%	37%	Thorndon	10%	10%	80%	90%
Onslow	63%	32%	5%	37%	Mount Victoria	14%	15%	70%	86%
Johnsonville North	63%	31%	6%	37%	Aro Valley	15%	15%	70%	85%
					Mount Cook West	15%	12%	72%	85%
JVL catchment	**58%**	**35%**	**7%**	**42%**	Pipitea-Kaiwharawhara	17%	13%	70%	83%
					Kelburn	18%	15%	67%	82%
					Newtown North	18%	39%	42%	82%
					Oriental Bay	20%	10%	70%	80%
					Newtown West	22%	41%	38%	78%
					Hataitai South	29%	50%	21%	71%
					Newtown South	30%	41%	29%	70%
					Brooklyn East	33%	32%	36%	67%
					Northland (Wellington City)	33%	28%	39%	67%
					Kilbirnie Central	36%	44%	20%	64%
					Berhampore	37%	39%	24%	63%
					Roseneath	37%	29%	35%	63%
					Hataitai North	39%	37%	24%	61%
					Wadestown	41%	25%	34%	59%
					Wilton	43%	40%	17%	57%
					Brooklyn North	43%	25%	33%	57%
					Kilbirnie East	45%	39%	16%	55%
					Brooklyn South	45%	32%	23%	55%
					Tawa Central	48%	47%	5%	52%
					Karori North	50%	33%	17%	50%
					Kingston-Mornington-Vogeltown	50%	35%	16%	50%
					Karori East	52%	30%	18%	48%
					Evans Bay	52%	37%	11%	48%
					Karori South	52%	38%	10%	48%
					Karori Park	53%	39%	8%	47%
					Miramar Central	55%	31%	14%	45%
					Tawa South	56%	40%	4%	44%
					Island Bay West	56%	32%	12%	44%
					Linden	56%	42%	2%	44%
					Lyall Bay	56%	32%	12%	44%
					Melrose	56%	33%	11%	44%
					Miramar North	58%	31%	11%	42%
					Houghton Bay	58%	29%	13%	42%
					Miramar South	58%	28%	14%	42%
					Maupuia	58%	34%	8%	42%
					Island Bay East	58%	29%	12%	42%
					Miramar East	61%	24%	15%	39%
					Tawa North	62%	36%	2%	38%
					Paparangi	63%	34%	4%	38%
					Newlands North	65%	31%	4%	35%
					Woodridge	65%	35%	0%	35%
					Broadmeadows	65%	34%	1%	35%
					Newlands South	67%	31%	2%	33%
					Grenada North	67%	31%	2%	33%
					Seatoun	68%	24%	7%	32%
					Strathmore (Wellington City)	69%	23%	8%	31%
					Churton Park South	71%	27%	2%	29%
					Southgate	71%	26%	3%	29%
					Churton Park North	75%	22%	3%	25%
					Grenada Village	75%	25%	0%	25%
					Owhiro Bay	75%	19%	6%	25%
					Karaka Bay-Worser Bay	79%	16%	6%	21%
					Makara-Ohariu	89%	11%	0%	11%
					Takapu-Horokiwi	100%	0%	0%	0%
					Rest of Wellington	**40%**	**27%**	**33%**	**60%**

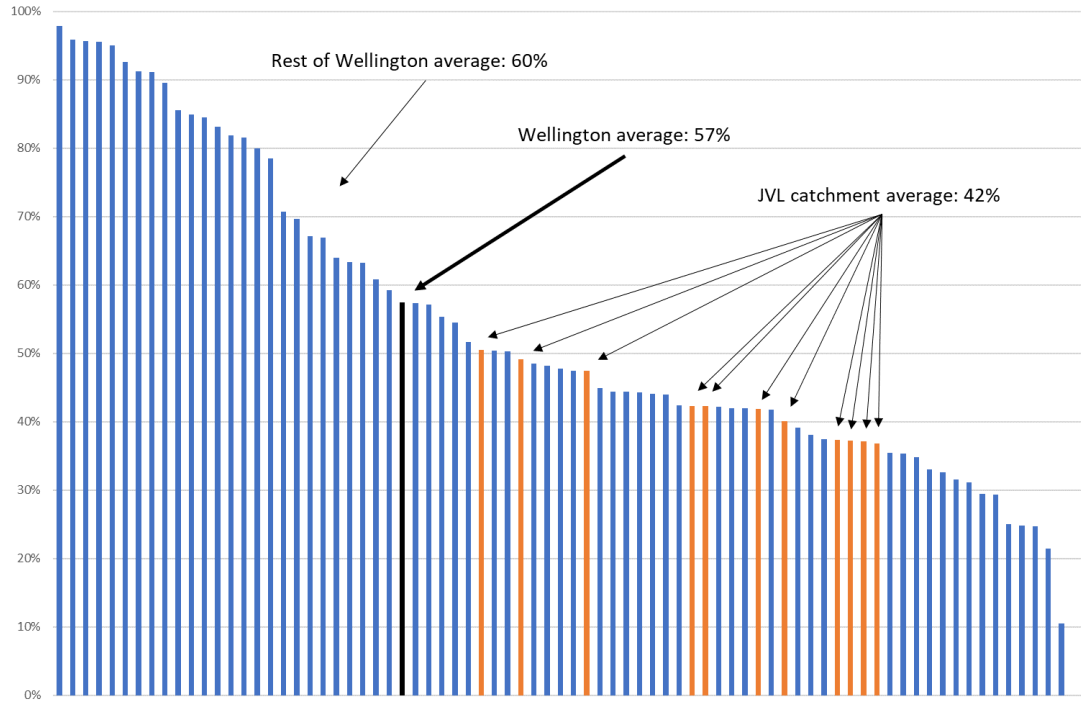
Source: Stats NZ 2018 Census Commuter View dataset. Notes: Car = driver + passenger, Public transport = Train + bus, Active = cycle + walk, Work from home/other excluded, average is SA2 population weighted

Chart 1: Car, active, and public transport share of work trips, Johnsonville line catchment vs rest of Wellington



Source: Stats NZ 2018 Census Commuter View dataset. Notes: Car = driver + passenger, Public transport = Train + bus, Active = cycle + walk, Work from home/other excluded, average is SA2 population weighted. JVL catchment SA2s as per Table 1.

Chart 2: Public transport + active share of work trips by Wellington SA2, high to low



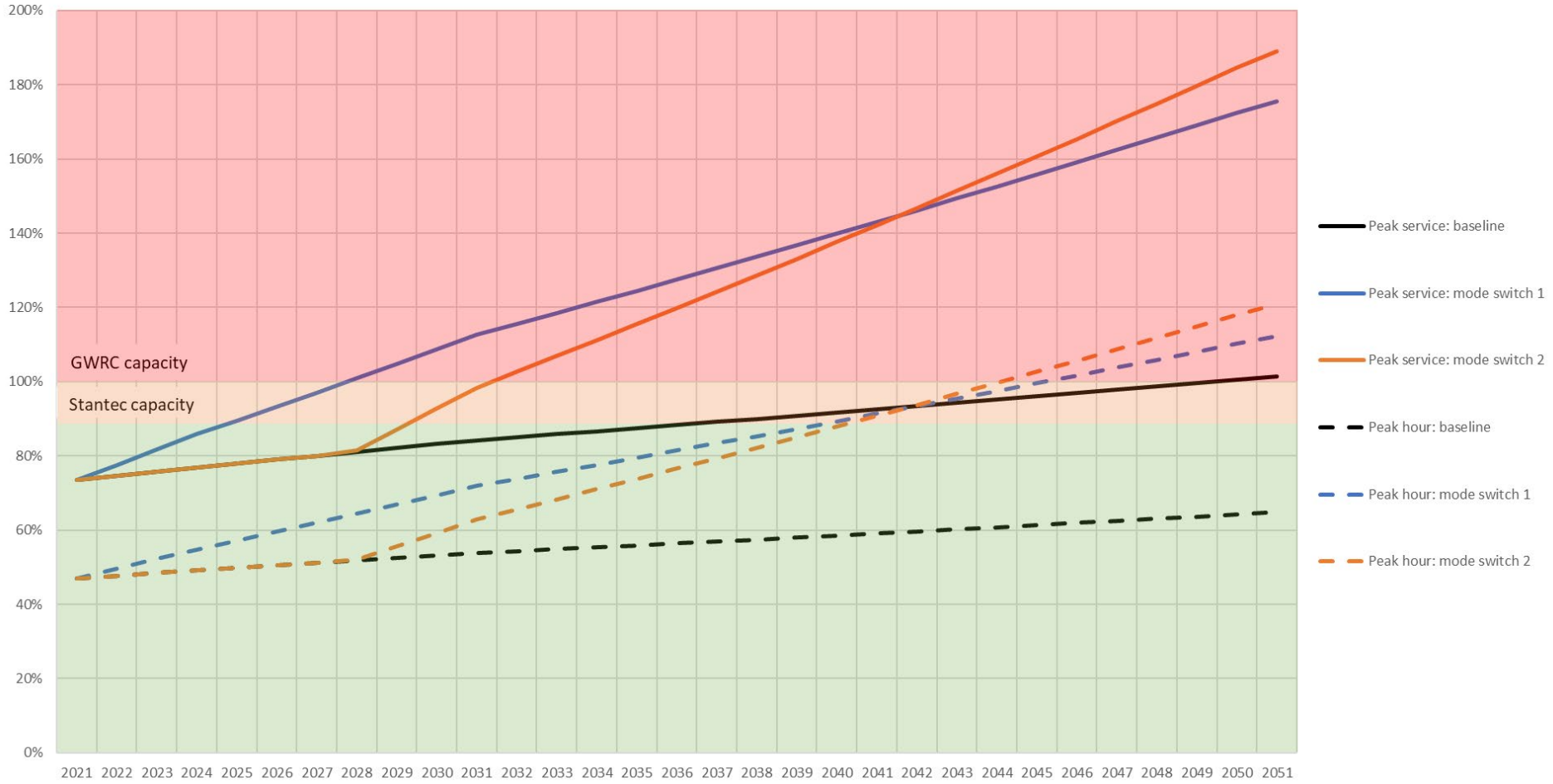
Source: Stats NZ 2018 Census Commuter View dataset. Notes: Car = driver + passenger, Public transport = Train + bus, Active = cycle + walk, Work from home/other excluded, average is SA2 population weighted. JVL catchment SA2s as per Table 1.

Table 2: Realisable development capacity and transport mode share by suburb, ordered by realisable capacity

	Realisable capacity		Transport mode share	
Suburb	**Dwellings**	**% total**	**Car**	**Public transport + active**
Te Aro	16,654	13.1%	5%	95%
Wellington Central	12,994	10.2%	2%	98%
Karori	10,356	8.1%	52%	48%
Khandallah	8,574	6.7%	61%	39%
Tawa	5,429	4.3%	56%	44%
Johnsonville	5,328	4.2%	60%	40%
Island Bay	5,143	4.0%	57%	43%
Miramar	4,622	3.6%	58%	42%
Brooklyn	4,511	3.5%	39%	61%
Thorndon	4,312	3.4%	10%	90%
Ngaio	4,036	3.2%	50%	50%
Mount Cook	3,662	2.9%	13%	87%
Seatoun	3,007	2.4%	68%	32%
Wadestown	2,899	2.3%	41%	59%
Pipitea-Kaiwharawhara	2,891	2.3%	17%	83%
Hataitai	2,703	2.1%	39%	61%
Newlands	2,542	2.0%	66%	34%
Kelburn	2,322	1.8%	12%	88%
Newtown	2,231	1.8%	24%	76%
Mount Victoria	1,831	1.4%	14%	86%
Churton Park	1,814	1.4%	73%	27%
Kilbirnie	1,689	1.3%	40%	60%
Crofton Downs	1,679	1.3%	58%	42%
Strathmore Park	1,661	1.3%	69%	31%
Kingston-Mornington-Vogeltown	1,578	1.2%	50%	50%
Northland	1,410	1.1%	33%	67%
Karaka Bays	1,022	0.8%	79%	21%
Lyall Bay	958	0.8%	56%	44%
Roseneath	920	0.7%	37%	63%
Wilton	899	0.7%	43%	57%
Aro Valley	862	0.7%	15%	85%
Melrose	851	0.7%	56%	44%
Houghton Bay	826	0.6%	58%	42%
Paparangi	770	0.6%	63%	38%
Southgate	746	0.6%	71%	29%
Berhampore	658	0.5%	37%	63%
Maupuia	646	0.5%	58%	42%
Grenada Village	590	0.5%	75%	25%
Owhiro Bay	558	0.4%	75%	25%
Woodridge	542	0.4%	65%	35%
Broadmeadows	351	0.3%	65%	35%
Oriental Bay	245	0.2%	20%	80%
Grenada North	39	0.0%	67%	33%
Makara-Ohariu	0	0.0%	89%	11%
Takapu-Horokiwi	0	0.0%	100%	0%
JVL catchment	**19,617**	**15%**	**58%**	**42%**
Rest of Wellington	**107,744**	**85%**	**34%**	**66%**
WELLINGTON	**127,361**	**100%**	**37%**	**63%**
Difference: JVL catchment vs rest of Wellington			24%	-24%

Sources: Realisable development capacity from HBA of DDP incl. MDRS, Property Economics (2022), Wellington City commercially feasible residential capacity assessment, June 2022, Table 4. Mode shares from Stats NZ 2018 Census Commuter View dataset. Notes: Suburb data generated by mapping SA2s into HBA suburbs as per Appendix 2.1 of May 2022 HBA. Car = driver + passenger, Public transport = Train + bus, Active = cycle + walk, Work from home/other excluded. Average mode shares for JVL / rest of Wellington / WELLINGTON are suburb mode shares weighted by realisable capacity.

Chart 3: Estimated peak service patronage and peak hour patronage relative to capacity, by mode switch scenario



Sources and methods: see Table 4.

Table 4: Estimated peak service patronage and peak hour patronage relative to capacity, by mode switch scenario – full results

Variable	Unit	Value																														
Year		**2021**	2022	2023	2024	2025	2026	2027	2028	2029	2030	**2031**	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	**2051**
Population																																
Wellington City	Residents	**219,016**	221,804	224,628	227,488	230,058	232,656	235,284	237,942	240,629	243,347	**246,096**	248,123	250,166	252,226	254,304	256,398	258,510	260,639	262,785	264,949	267,131	269,331	271,550	273,786	276,041	278,314	280,606	282,917	285,247	287,596	**289,714**
	Growth		2,788	2,824	2,860	2,570	2,599	2,628	2,658	2,688	2,718	**2,749**	2,027	2,043	2,060	2,077	2,094	2,112	2,129	2,147	2,164	2,182	2,200	2,218	2,236	2,255	2,273	2,292	2,311	2,330	2,349	**2,118**
	Growth (% p.a.)		1.3%	1.3%	1.3%	1.1%	1.1%	1.1%	1.1%	1.1%	1.1%	**1.1%**	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%	**0.8%**
	Growth (since 2021)	-	2,788	5,612	8,472	11,042	13,640	16,268	18,926	21,613	24,331	**27,080**	29,107	31,150	33,210	35,288	37,382	39,494	41,623	43,769	45,933	48,115	50,315	52,534	54,770	57,025	59,298	61,590	63,901	66,231	68,580	**70,698**
	Growth (% since 2021)	**0%**	1%	3%	4%	5%	6%	7%	9%	10%	11%	**12%**	13%	14%	15%	16%	17%	18%	19%	20%	21%	22%	23%	24%	25%	26%	27%	28%	29%	30%	31%	**32%**
JVL catchment	Residents	**28,777**	29,206	29,641	30,082	30,478	30,878	31,283	31,692	32,106	32,525	**32,948**	33,260	33,575	33,892	34,212	34,535	34,860	35,188	35,519	35,852	36,188	36,527	36,869	37,213	37,560	37,910	38,263	38,619	38,978	39,340	**39,666**
	Growth		429	435	440	396	400	405	409	414	419	**423**	312	315	317	320	323	325	328	331	333	336	339	342	344	347	350	353	356	359	362	**326**
	Growth (% p.a.)		1.5%	1.5%	1.5%	1.3%	1.3%	1.3%	1.3%	1.3%	1.3%	**1.3%**	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%	**0.8%**
	Growth (since 2021)	-	429	864	1,305	1,701	2,101	2,506	2,915	3,329	3,748	**4,171**	4,483	4,798	5,115	5,435	5,758	6,083	6,411	6,742	7,075	7,411	7,750	8,092	8,436	8,783	9,133	9,486	9,842	10,201	10,563	**10,889**
	Growth (% since 2021)	**0%**	1%	3%	5%	6%	7%	9%	10%	12%	13%	**14%**	16%	17%	18%	19%	20%	21%	22%	23%	25%	26%	27%	28%	29%	31%	32%	33%	34%	35%	37%	**38%**
Baseline scenario: no mode switch																																
Peak service patronage	Passengers	**362**	367	373	378	383	388	394	399	404	409	**414**	418	422	426	430	434	439	443	447	451	455	459	464	468	472	477	481	486	490	495	**499**
	Passengers (% capacity)	**74%**	75%	76%	77%	78%	79%	80%	81%	82%	83%	**84%**	85%	86%	87%	87%	88%	89%	90%	91%	92%	93%	93%	94%	95%	96%	97%	98%	99%	100%	101%	**101%**
	Growth (since 2021)	-	5	11	16	21	26	32	37	42	47	**52**	56	60	64	68	72	77	81	85	89	93	97	102	106	110	115	119	124	128	133	**137**
	Growth (% since 2021)	**0%**	1%	3%	5%	6%	7%	9%	10%	12%	13%	**14%**	16%	17%	18%	19%	20%	21%	22%	23%	25%	26%	27%	28%	29%	31%	32%	33%	34%	35%	37%	**38%**
	Spare capacity	**130**	125	119	114	109	104	98	93	88	83	**78**	74	70	66	62	58	53	49	45	41	37	33	28	24	20	15	11	6	2	- 3	- **7**
	Spare capacity (%)	26%	25%	24%	23%	22%	21%	20%	19%	18%	17%	**16%**	15%	14%	13%	13%	12%	11%	10%	9%	8%	7%	7%	6%	5%	4%	3%	2%	1%	**0%**	**-1%**	**-1%**
Peak hour patronage	Passengers	**925**	939	953	967	980	993	1,006	1,019	1,032	1,045	**1,059**	1,069	1,079	1,089	1,100	1,110	1,121	1,131	1,142	1,152	1,163	1,174	1,185	1,196	1,207	1,219	1,230	1,241	1,253	1,265	**1,275**
	Passengers (% capacity)	**47%**	48%	48%	49%	50%	50%	51%	52%	52%	53%	**54%**	54%	55%	55%	56%	56%	57%	57%	58%	59%	59%	60%	60%	61%	61%	62%	62%	63%	64%	64%	**65%**
	Growth (since 2021)	-	14	28	42	55	68	81	94	107	120	**134**	144	154	164	175	185	196	206	217	227	238	249	260	271	282	294	305	316	328	340	**350**
	Growth (% since 2021)	**0%**	1%	3%	5%	6%	7%	9%	10%	12%	13%	**14%**	16%	17%	18%	19%	20%	21%	22%	23%	25%	26%	27%	28%	29%	31%	32%	33%	34%	35%	37%	**38%**
	Spare capacity	**1,043**	1,029	1,015	1,001	988	975	962	949	936	923	**909**	899	889	879	868	858	847	837	826	816	805	794	783	772	761	749	738	727	715	703	**693**
	Spare capacity (%)	53%	52%	52%	51%	50%	50%	49%	48%	48%	47%	**46%**	46%	45%	45%	44%	44%	43%	43%	42%	41%	41%	40%	40%	39%	39%	38%	38%	37%	36%	36%	35%
Peak road traffic volumes	Growth (% since 2021)	**0%**	1%	3%	5%	6%	7%	9%	10%	12%	13%	**14%**	16%	17%	18%	19%	20%	21%	22%	23%	25%	26%	27%	28%	29%	31%	32%	33%	34%	35%	37%	**38%**
Mode switch scenario 1: all new WGN station catchment trips by rail																																
Peak service patronage	Passengers	**362**	382	402	422	440	459	477	496	515	535	**554**	569	583	598	612	627	642	657	673	688	703	719	735	751	767	783	799	815	832	849	**864**
	Passengers (% capacity)	**74%**	78%	82%	86%	89%	93%	97%	101%	105%	109%	**113%**	116%	118%	121%	124%	127%	131%	134%	137%	140%	143%	146%	149%	153%	156%	159%	162%	166%	169%	172%	**176%**
	Growth (since 2021)	-	20	40	60	78	97	115	134	153	173	**192**	207	221	236	250	265	280	295	311	326	341	357	373	389	405	421	437	453	470	487	**502**
	Growth (% since 2021)	**0%**	5%	11%	17%	22%	27%	32%	37%	42%	48%	**53%**	57%	61%	65%	69%	73%	77%	82%	86%	90%	94%	99%	103%	107%	112%	116%	121%	125%	130%	134%	**139%**
	Spare capacity	**130**	110	90	70	52	33	15	- 4	- 23	- 43	- **62**	- 77	- 91	- 106	- 120	- 135	- 150	- 165	- 181	- 196	- 211	- 227	- 243	- 259	- 275	- 291	- 307	- 323	- 340	- 357	- **372**
	Spare capacity (%)	26%	22%	18%	14%	11%	7%	3%	-1%	-5%	-9%	**-13%**	-16%	-18%	-21%	-24%	-27%	-31%	-34%	-37%	-40%	-43%	-46%	-49%	-53%	-56%	-59%	-62%	-66%	-69%	-72%	**-76%**
Peak hour patronage	Passengers	**925**	976	1,027	1,079	1,125	1,172	1,220	1,268	1,317	1,366	**1,416**	1,453	1,490	1,527	1,565	1,603	1,641	1,680	1,719	1,758	1,797	1,837	1,877	1,918	1,959	2,000	2,042	2,083	2,126	2,168	**2,207**
	Passengers (% capacity)	**47%**	50%	52%	55%	57%	60%	62%	64%	67%	69%	**72%**	74%	76%	78%	80%	81%	83%	85%	87%	89%	91%	93%	95%	97%	100%	102%	104%	106%	108%	110%	**112%**
	Growth (since 2021)	-	51	102	154	200	247	295	343	392	441	**491**	528	565	602	640	678	716	755	794	833	872	912	952	993	1,034	1,075	1,117	1,158	1,201	1,243	**1,282**
	Growth (% since 2021)	**0%**	5%	11%	17%	22%	27%	32%	37%	42%	48%	**53%**	57%	61%	65%	69%	73%	77%	82%	86%	90%	94%	99%	103%	107%	112%	116%	121%	125%	130%	134%	**139%**
	Spare capacity	**1,043**	992	941	889	843	796	748	700	651	602	**552**	515	478	441	403	365	327	288	249	210	171	131	91	50	9	- 32	- 74	- 115	- 158	- 200	- **239**
	Spare capacity (%)	53%	50%	48%	45%	43%	40%	38%	36%	33%	31%	**28%**	26%	24%	22%	20%	19%	17%	15%	13%	11%	9%	7%	5%	3%	0%	-2%	-4%	-6%	-8%	-10%	**-12%**
Peak road traffic volumes	Growth (% since 2021)	**0%**	1%	1%	2%	2%	3%	3%	4%	4%	5%	**5%**	6%	6%	7%	7%	8%	8%	8%	9%	9%	10%	10%	11%	11%	12%	12%	12%	13%	13%	14%	**14%**
Mode switch scenario 2: growth in peak trips to all destinations capped at 10%																																
Peak service patronage	Passengers	**362**	367	373	378	383	388	394	401	428	456	**484**	505	526	547	568	589	611	633	655	677	699	722	744	767	790	814	837	861	885	909	**930**
	Passengers (% capacity)	**74%**	75%	76%	77%	78%	79%	80%	81%	87%	93%	**98%**	103%	107%	111%	115%	120%	124%	129%	133%	138%	142%	147%	151%	156%	161%	165%	170%	175%	180%	185%	**189%**
	Growth (since 2021)	-	5	11	16	21	26	32	39	66	94	**122**	143	164	185	206	227	249	271	293	315	337	360	382	405	428	452	475	499	523	547	**568**
	Growth (% since 2021)	**0%**	1%	3%	5%	6%	7%	9%	11%	18%	26%	**34%**	39%	45%	51%	57%	63%	69%	75%	81%	87%	93%	99%	106%	112%	118%	125%	131%	138%	144%	151%	**157%**
	Spare capacity	**130**	125	119	114	109	104	98	91	64	36	**8**	- 13	- 34	- 55	- 76	- 97	- 119	- 141	- 163	- 185	- 207	- 230	- 252	- 275	- 298	- 322	- 345	- 369	- 393	- 417	- **438**
	Spare capacity (%)	26%	25%	24%	23%	22%	21%	20%	19%	13%	7%	**2%**	-3%	-7%	-11%	-15%	-20%	-24%	-29%	-33%	-38%	-42%	-47%	-51%	-56%	-61%	-65%	-70%	-75%	-80%	-85%	**-89%**
Peak hour patronage	Passengers	**925**	939	953	967	980	993	1,006	1,024	1,094	1,165	**1,237**	1,290	1,343	1,397	1,452	1,506	1,561	1,617	1,673	1,730	1,787	1,844	1,902	1,961	2,020	2,079	2,139	2,199	2,260	2,322	**2,377**
	Passengers (% capacity)	**47%**	48%	48%	49%	50%	50%	51%	52%	56%	59%	**63%**	66%	68%	71%	74%	77%	79%	82%	85%	88%	91%	94%	97%	100%	103%	106%	109%	112%	115%	118%	**121%**
	Growth (since 2021)	-	14	28	42	55	68	81	99	169	240	**312**	365	418	472	527	581	636	692	748	805	862	919	977	1,036	1,095	1,154	1,214	1,274	1,335	1,397	**1,452**
	Growth (% since 2021)	**0%**	1%	3%	5%	6%	7%	9%	11%	18%	26%	**34%**	39%	45%	51%	57%	63%	69%	75%	81%	87%	93%	99%	106%	112%	118%	125%	131%	138%	144%	151%	**157%**
	Spare capacity	**1,043**	1,029	1,015	1,001	988	975	962	944	874	803	**731**	678	625	571	516	462	407	351	295	238	181	124	66	7	- 52	- 111	- 171	- 231	- 292	- 354	- **409**
	Spare capacity (%)	53%	52%	52%	51%	50%	50%	49%	48%	44%	41%	**37%**	34%	32%	29%	26%	23%	21%	18%	15%	12%	9%	6%	3%	0%	-3%	-6%	-9%	-12%	-15%	-18%	**-21%**
Peak road traffic volumes	Growth (% since 2021)	**0%**	1%	3%	5%	6%	7%	9%	10%	10%	10%	**10%**	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	**10%**
Colour key:	Patronage within capacity																															
	Patronage exceeds Stantec "maximum comfortable capacity"																															
	Patronage exceeds GWRC-defined capacity																															

Sources: Population/realisable capacity: May 2022 HBA. Mode/destination trip distribution: 2018 Census Commuter View. Assumptions/methods: Baseline patronage grows at population growth (HBA Wellington projection scaled by JVL share of realisable capacity, 15%). Mode switch 1: all JVL catchment origin, WGN catchment destination, trips go by rail. Calculation: baseline, plus baseline trip growth since 2021 scaled up by current ratio of car/bus to rail trips with WGN destination (=2.7). Mode switch 2: new car/bus trips (all destinations) capped at 10%. Calculation: baseline, plus baseline trip growth since 2021 in excess of 10% scaled up by current ratio of car/bus trips (all destination) per WGN rail trip (=4.3).

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Summary

An economist with experience in transport, housing, taxation, environmental regulation, gambling licensing and more. Currently a freelance consultant; previously employed by Ernst & Young (Australia), the Victorian Treasury, and the NZ Treasury. PhD from Melbourne University focusing on the economics of land tax.

Qualifications

- PhD in Economics, University of Melbourne (2012)
- Master of Commerce (Hons), University of Melbourne (2005)
- B.Comm (Hons 1st Class) / B.Sci, Victoria University of Wellington (2004)

Experience

Freelance consulting clients and engagements, and short-term work (2017–)	
Auckland Council	**Infrastructure funding: economic impacts and equity of development contributions** Prepared reports on the incidence and housing supply impacts of higher DCs and the equity of DCs vis-à-vis alternative funding models for growth infrastructure.
Oxfam NZ / Tax Justice Aotearoa	**'Talking Tax' researcher** Tax policy, campaigning and messaging advice for Oxfam and TJA delivered following interviews with 24 of NZ's leading tax commentators.
Grattan Institute	**Senior Associate – Household Finances program** Short-term employment to draft op-eds and prepare a Parliamentary committee submission on wage subsidy and labour hire incentive schemes.
NSW Treasury	**Federal Financial Relations Review (Thodey review)** Drafted chapters on land taxes, stamp duty, payroll tax, and insurance taxes on behalf of the review secretariat.
Department of Transport (VIC)	**Economic analysis – Public transport fares first-principles review** Co-author of internal review contributing data analysis, modelling, academic literature review, oversight of transport modelling consultants, briefings and drafting.
Prosper Australia (NGO)	**Submissions – NSW federalism review and NSW Productivity Commission review** Prepared submissions on land tax, value capture and developer contributions for NSW reviews, plus presentation to federalism review (Thodey review) panel.
	Commissioned research – 'Land tax to stamp duty: designing the transition' Authored a publicly released report on transitioning to land tax and presented findings to the Australian Conference of Economists, Treasury (Victoria), and the Productivity Commission.
Department of Environment, Land, Water and Planning (VIC)	**Marginal abatement cost modelling – Water sector greenhouse gas emissions** Design and execution of an emissions forecasting and MAC modelling exercise to inform regulated emissions reduction targets for Victoria's water sector.
	Cost-benefit analysis and discussion paper – Wildlife regulations Preparation of CBA, fees design work, and drafting of a consultation paper in advance of the Regulatory Impact Statement process for the re-making of regulations.
	Regulatory impact assessment – Combustible recycling regulations Preparation of regulatory impact assessment for new regulations reducing fire risk at recycling and waste disposal facilities.
	Cost-benefit analysis – Evaluation of wildlife trial CBA methodology development and analysis to evaluate a pilot program relating to wildlife.
	Regulatory options analysis – Kangaroo processing industry Economic impact assessment of regulatory options for kangaroo pet food industry reforms, including design of cost recovery arrangements.
	Economic impact assessment – Environment Protection Authority reforms Modelling, analysis and report drafting for an assessment of major reforms introducing a 'general duty of environmental care' and new licensing system to the E.
	Economic impact assessment – E-Waste reforms Literature review, economic advice, and report drafting as part of an impact assessment for introduction of a state-wide e-waste recovery system.
Department of Treasury and Finance (VIC)	**Racing and wagering industry advice** Advice, modelling, and industry engagement in relation to wagering taxation.

Ernst & Young clients and engagements (2015 – 2017)	
Department of Treasury and Finance (VIC)	**Infrastructure 'value capture' taxes** Development and modelling of value capture strategy for a major transport project.
	Value capture policy development Drafted a discussion paper and supporting materials for value capture policy work.
Infrastructure Victoria	**Value capture discussion paper** Advice and report drafting regarding value capture rationale, opportunities, and mechanisms.
Department of Environment, Land, Water and Planning (VIC)	**Climate change targets: impact assessment** Modelling and report drafting for an assessment of economic impacts of meeting various potential CO2 emissions target options.
	Renewable energy decision framework Developed options for a whole-of-government policy for investment in renewables and procurement of renewable energy by government agencies.
Department of Industry and Regional Development (Commonwealth)	**Value capture taxes: policy advice** Advice and drafting of a discussion paper on value capture principles and instruments (developer contributions, land taxes, land value uplift taxation).
Department of Planning and Environment (NSW)	**Developer infrastructure contributions policy advice** Economic analysis and development of a policy case for developer contributions to fund infrastructure in urban renewal areas (in support of Parramatta light rail SIC).
Level Crossing Removal Authority (VIC)	**Business case preparation and cost-benefit analysis (CBA)** Development of methodology and value capture strategy for $7bn level crossing removal program CBA, and drafting around half of the business case.
	Business case and CBA reviews – Rail projects Peer review of business cases and cost-benefit analyses for various rail projects
Department of Justice and Regulation (VIC)	**Options analysis – Lotteries licensing** Advised on alternative approaches to issuing a new licence for lotteries in Victoria.
Tourism Victoria	**Business case – Cruise ship terminal** Drafted preliminary business case for new cruise ship infrastructure investment.
Health sector client	**Options analysis – Bionics industry funding models** Development, modelling and assessment of funding models for a major new research facility to support Victoria's bionics industry.
Gambling industry client	**Economic advice – Gambling licensing** Assistance in developing arguments for submission to a licensing review.
Ernst & Young (EY)	**South Australia tax review submission** Author of EY-branded public submission to the 2015 South Australian tax review.
Prior employment	
Department of Treasury and Finance (VIC) (2010-2014)	**Tax policy analysis and reform projects** Ongoing: research, analysis and modelling for state taxes (land tax, stamp duty, and value capture taxes). Project: implement a change to first home buyer tax policies.
	Wagering tax review Led a review (tabled in Parliament) of taxes on wagering and racing industry funding, involving revenue forecasting, economic advice, and industry consultation
	Casino licence negotiation support Policy and strategic advice and financial modelling for casino licence renegotiation.
	Submission to federal review of state grant funding Literature review and drafting of economic efficiency/equity arguments relating to horizontal fiscal equalisation, for Victoria's submissions to Brumby/Greiner review
Melbourne University (2006-2008)	**Tutoring** Masters-level Macroeconomics, 3rd year International Economics, 2nd year Globalisation and the World Economy, 1st and 2nd year Microeconomics
New Zealand Treasury (2004-2005)	**Research assistant** Research on productivity and returns to R+D for agricultural industries, and review of literature on the value of non-market work for a labour force participation report.

Publicly available written work (sample)

- Independent report, "Equity of options for funding long-term infrastructure investment", for Auckland Council (2022)
- Op-ed, "The biggest bang for the stimulus buck", Inside Story (2020)
- Think tank report, "Land tax to stamp duty: designing the transition", Prosper Australia (2019)
- Government report, "Combustible Waste and Recyclable Material", Environment department, Victoria (2018)
- Public submission, "Land gains tax as value capture and tax reform", South Australian Tax Review (2015)
- PhD thesis: "Essays on the economics of price transmission", University of Melbourne (2012)