

Basin Bridge Project Traffic and Transportation Effects Peer Review



Basin Bridge Project Traffic and Transportation Effects Peer Review

Job No.	Prepared by	Verified by	Approved by	Status	Issue No.	Date
4319	AD/DS/PD	DS/PD	PD	Draft	1	22/11/2013
4319	AD/DS/PD	DS/PD	PD	Final	1	25/11/2013

This document has been produced for the sole use of our client. Any use of this document by a third party is without liability and you should seek independent traffic and transportation advice. © No part of this colour document may be copied without the written consent of either our client or Abley Transportation Consultants Limited

Abley Transportation Consultants Limited

Christchurch phone +64(0)3 377 4703 fax +64(0)3 377 4700
Level 1 and 2, 30a Carlyle Street, PO Box 25350, Christchurch 8144, New Zealand

www.abley.com info@abley.com

Auckland phone +64(0)9 974 9820 fax +64(0)9 974 9824
PO Box 911336, Auckland 1142, New Zealand



CONTENTS

1	INTRODUCTION	1
	Background	1
	Scope of Review	1
	Document Contents	2
2	TRAFFIC AND TRANSPORTATION EFFECTS REVIEW	3
	Introduction	3
	Consideration of Alternatives	3
	Traffic and Transport Assessment	9
	Summary	18
3	TRANSPORT MODELLING REVIEW	20
	Introduction	20
	Use of Transport Models	20
	Roles of Models and Modal Split	21
	Inputs and Assumptions	22
	Model Calibration and Validation	24
	Sensitivity Testing	28
	Assessment of the Alternative Options Omnibus Modelling	29
	Assessment of Pirie / Kent / Cambridge / Vivian Intersection Memorandum	30
	Paramics Network Coding Review	31
4	SUMMARY OF REVIEW FINDINGS	38

FIGURES

Figure 2.1	Hania / Ellice Street Intersection Layout	14
Figure 2.2	Paterson Street / Dufferin Street intersection layout	15
Figure 2.3	Rugby Street / Adelaide Road intersection layout	16
Figure 3.1	Route 1 Westbound AM Peak Cumulative Travel Time (from Appendix 4-B)	28
Figure 3.2	Modelled Bus Lane Layout on Courtenay Place	31
Figure 3.3	Evening Peak Bus Lane Issue on Cambridge Terrace	32
Figure 3.4	Interpeak Bus Lane Issue on Adelaide Road	33
Figure 3.5	SH1 / Willis St / Abel Smith St Intersection Comparison	34
Figure 3.6	Arthur St Intersections Comparison	35
Figure 3.7	Eastern Overbridge Connection Comparison	37

TABLES

Table 2.1	Scoring Attributed to the Effects Ratings	4
Table 2.2	Scoring Attributed to the Option Evaluation	5
Table 2.3	Scoring Applied to the Simplified Decision Matrix	6
Table 2.4	Simplified Option Matrix for Preferred Option and Option F	8
Table 2.5	Do Minimum Journey Speeds on Selected Routes for 2021 Peak Periods	11
Table 3.1	SATURN Flow Validation Check	26
Table 3.2	Summary of SATURN Flow Validation	26

1 INTRODUCTION

Background

- 1.1 Abley Transportation Consultants have been commissioned by the Environmental Protection Authority (EPA) on behalf of the Board of Inquiry to supply a peer review of traffic and transportation related aspects of New Zealand Transport Agency's Basin Bridge Application.
- 1.2 NZTA have lodged a Notice of Requirement (NOR) and resource consent applications to construct, operate and maintain a two-lane, one-way bridge for westbound traffic on State Highway 1. The project will connect Paterson Street with Buckle Street via a grade-separated bridge on the northern side of the Basin Reserve. A shared walking and cycling path will be provided on the northern side of the bridge. A number of improvements to streets and intersections in the vicinity of the bridge also form part of the project.
- 1.3 The project, known as the Basin Bridge is identified as a sub-project of the Wellington Northern Corridor project, which is one of the Government's 'Road of National Significance' (RoNS) projects.
- 1.4 The NZTA lodged the application with the Environmental Protection Authority (EPA) as a nationally significant proposal. In August 2013, the Minister announced that the Basin Bridge proposal would be heard by an independent Board of Inquiry. The Board of Inquiry is seeking independent professional advice in respect of traffic and transport matters related to the application.
- 1.5 The key document in this review is 'Technical Report 4: Assessment of Traffic and Transportation Effects' report prepared by Opus International Consultants, including the 11 supporting appendices. The review focuses predominantly on this report and includes other key documents contained within the application lodged with the EPA to further understand the assumptions, inputs or analysis techniques underlying the applications.

Scope of Review

- 1.6 The scope of the review as specified in the Board Memorandum #14 dated 6th November 2013, is to complete a peer review of the:
- Consideration of alternatives;
 - Traffic and transport assessment with particular regard to:
 - The overall methodology used to assess the effects;
 - The present traffic and transportation situation around the Basin Reserve and surrounding road network; and
 - The future traffic and transportation scenarios and modelling undertaken to predict them.
 - Assessment of construction effects on traffic and transportation for all modes and the conditions proposed to address them.
- 1.7 In consideration of the transport modelling undertaken to support the assessment of the traffic and transportation effects, the review covers the appropriateness of:
- The application of the models used;
 - Roles of the models as they relate to modal split;

- Inputs and assumptions used for each scenario;
- Calibration and validation; and
- Sensitivity testing of key variables.

1.8 The scope of the review is limited to the consideration of the content of the documents lodged with the EPA. It is acknowledged that additional information to satisfy aspects of the review may be available in supporting documents that are not included with the application. Where this may be the case the supporting documents have not been consulted, and any gaps in the provision of information are highlighted herein.

1.9 The sole exception relates to s-Paramics transport modelling files which have been requested such that network coding checks of the future do-minimum and option networks can be completed. This was considered to be critical to the review, ensuring the validity of any findings published based upon transport modelling outputs.

1.10 It is important to recognise that the role of the peer review is to review the technical content of the application and not to form a view on the merits of the Basin Bridge project.

Document Contents

1.11 This report is broken into several sections as follows:

- The review of the traffic and transportation effects are addressed in section 2. Section 2 also addresses the assessment of alternatives;
- Issues specific to the review of transport modelling aspects are included in section 3; and
- A summary of the findings of the review are presented as a table in section 4.

2 TRAFFIC AND TRANSPORTATION EFFECTS REVIEW

Introduction

- 2.1 The traffic and transportation effects review focuses on the impacts to all modes of transport and the consideration of the alternative options for the Basin Reserve provided within the suite of EPA documents. The following key documents have been reviewed:
- Technical Report 1: Design Philosophy Statement;
 - Technical Report 4: Assessment of Traffic and Transportation Effects, including the appendices;
 - Technical Report 19: Alternative Options Omnibus; and
 - Draft Construction Transport Management Plan.
- 2.2 A high level review of the statements of evidence submitted by the NZ Transport Agency (NZTA) in support of the application lodged with the EPA has also been carried out.
- 2.3 This peer review has not included a dedicated site visit, as it should be considered a desktop review of the documents accompanying the resource consent application. The reviewers have some prior knowledge of the site and have supplemented this with imagery available via the Internet.

Consideration of Alternatives

- 2.4 An extensive array of options to improve connectivity between the Mt Victoria Tunnel and Buckle Street, and to improve local transport conditions in and around the Basin Reserve have been considered by the NZTA. In most instances, each main option has included a number of sub-option permutations to evaluate different methods of achieving a similar outcome within the same project footprint. Overall, reasonable steps have been taken to ensure that an appropriate number of options and sub-options, ranging from the predictable to more obscure approaches, have been considered as a means of delivering the project. In the opinion of the reviewers, no obvious options appear to have been overlooked and as such the range of alternatives considered is comprehensive and complete. Notwithstanding, it is acknowledged that other options may exist for delivering the project objectives.
- 2.5 The Alternative Options Omnibus: Technical Report 19 (TR19) outlines the evaluation criteria used to arrive at the preferred option. The process is largely qualitative and relies on the professional judgement of experts in a range of disciplines. While more quantitative criteria would improve the robustness and objectivity of the evaluation process, it is acknowledged that for a project of this scale it is unreasonable to subject all possible options to exhaustive technical analysis which is typically reserved for a preferred option or options.

Initial Options

- 2.6 An initial suite of five options were assessed the evaluation criteria as reported in section 5.3 of TR19. The option evaluation does not identify whether certain evaluation criteria were given more weighting than others. This makes following the process published in TR19 to arrive at the preferred options more difficult to follow.

2.7 The reviewers have attempted to replicate the selection process used to arrive at the preferred option(s) by applying an arbitrary scoring system to the negative and positive effects ratings presented in TR19, as outlined in **Table 2.1**.

Table 2.1 Scoring Attributed to the Effects Ratings

Negative		Positive	
Severe Negative	-8	Minor Positive	2
Significant Negative	-6	Moderate Positive	4
Moderate Negative	-4	Significant Positive	6
Minor Negative	-2	Substantial Positive	8
Insignificant	0		

2.8 These scores have been applied to each of the criteria for each of the Opus Options A through E reported in section 5.3 of TR19. Equal weighting has been assumed for each criteria to arrive at the overall scoring, as demonstrated in **Table 2.2** (over). This analysis concludes that Opus Option D is the highest ranking, however it is acknowledged that the results are likely to be sensitive to the scoring quantum and relative weightings of the criteria.

Table 2.2 Scoring Attributed to the Option Evaluation

Criteria	Option A		Option B		Option C		Option D		Option E	
Social	Minor positive	2	Minor positive	2	Insignificant	0	Insignificant	0	Minor negative	-2
Ecology	Minor negative	-2								
Archaeology	Significant negative (minor negative with mitigation).	-6	Significant negative (minor negative with mitigation).	-6	Significant negative (minor negative with mitigation).	-6	Significant negative (minor negative with mitigation).	-6	Significant negative (minor negative with mitigation).	-6
Air quality	Minor negative to insignificant	-2	Minor negative to insignificant	-2	Minor negative	-2	Insignificant	0	Insignificant	0
Noise	Minor negative	-2								
Built Heritage	Severe negative	-8	Significant negative	-6	Moderate negative	-4	Moderate negative	-4	Significant negative	-6
Urban Design	Minor negative	-2	Moderate negative	-4	Moderate negative	-4	Moderate negative	-4	Significant negative	-6
<i>Urban Design (Review)*</i>	<i>Moderate negative</i>	<i>-4</i>	<i>Significant negative</i>	<i>-6</i>	<i>Significant / moderate negative</i>	<i>-6</i>	<i>Significant negative</i>	<i>-6</i>	<i>Significant / moderate negative</i>	<i>-6</i>
Total		-20		-20		-20		-18		-24
<p>* Urban Design (Review) scores are not considered in the Total due to the anticipation that this would lead to double counting. It is assumed that Urban Design (Review) rankings have been superseded by the Urban Design rankings due to modifications to the design.</p>										

2.9 Similarly, by applying scoring to each of the criteria in the simplified decision matrix shown in Table 19.11 of TR 19, and assuming an equal weighting for each, the merits of the alternative options can be scored as demonstrated in **Table 2.3**. This analysis concludes that Option A through to Option D have equal merit, however it is again acknowledged that the results are likely to be sensitive to the scoring quantum and relative weightings of the criteria.

Table 2.3 Scoring Applied to the Simplified Decision Matrix

Criteria	Social		Built Heritage		Urban Design		Total
Option A	Minor positive	2	Severe negative	-8	Minor negative	-2	-8
Option B	Minor positive	2	Significant negative	-6	Moderate negative	-4	-8
Option C	Insignificant	0	Moderate negative	-4	Moderate negative	-4	-8
Option D	Insignificant	0	Moderate negative	-4	Moderate negative	-4	-8
Option E	Minor negative	-2	Significant negative	-6	Significant negative	-6	-14

2.10 The evaluation process resulted in Option A and B being identified as the preferred options and these were taken forward for public consultation. This decision is supported by a number of conclusions regarding the simplified decision matrix; however the reviewers do not fully agree with the following conclusions:

- The conclusion that “... the differences between the at-grade and grade-separated options in terms of economic benefits and BCR is relatively small for an urban project of this nature...”¹ The reviewers do not share this view. While such a view could be considered reasonable for an improvement project costing less than say \$2,000,000 where the difference in benefits between options is less than \$500,000; this approach effectively dismisses multi-million dollar returns on investment between the options as being insignificant.

A comparison of the Transport criteria for Option A and Option D indicated that Option A had a BCR of 1.1 to 1.2 while Option D had a greater BCR of 1.4 to 1.6. Option A reduced westbound travel time by up to 54% compared with 30% for Option D. The network wide travel time benefits for Option A were \$7.1 million compared to \$4.2 million for Option D. The estimated project costs for Option A were \$75 million and \$100 million compared to estimated costs of between \$40 million to \$50 million for Option D.

So while Option A was forecast to achieve greater travel time savings (up to 24%) and \$2.9 million more travel time benefits than Option D, the BCR for Option D was higher and the project costs were in the region of \$25-60 million less than Option A.

- While it is acknowledged that Social, Built Heritage and Urban Design are important evaluation criteria for any project, these matters are not reflected in the Project Objectives described in Section 4.4 of Technical Report 4 (TR4). The project objectives exclusively relate to transport outcomes around efficiency, economic growth, modal choice and safety improvements. Given the Project Objectives, the reviewers consider these matters should have been given greater weighting in the evaluation process and for that reason, consider

¹ Basin Bridge Project, Technical Report 19, Alternative Options Omnibus, Section 5.3.3

Options C and D may have been dismissed from further consideration for reasons outside of the project objectives.

- In respect of the Social, Built Heritage and Urban Design evaluation criteria, it is unclear as to the basis for giving more weighting to Social and Urban Design criteria over Built Heritage. This particular decision appears to have been the sole factor which resulted in Options A and B being preferred over Options C and D, as Options A and B have Severe and Significant adverse effects on Built Heritage compared to Options C and D, yet only offer minor benefits in respect of Social and Urban Design matters.
- The evaluation discussion also identifies that Options A and B are likely to be compatible with the potential future upgrade of the Inner City Bypass between the Terrace Tunnel and Mount Victoria Tunnel. While this may well be the case, the report does not identify the extent to which Options C and D preclude future projects such as duplication of Mount Victoria Tunnel. The lack of information on this matter does not allow the reviewers to understand the compatibility, or lack of, between future projects along the corridor and Options that have been dismissed.

2.11 The reviewers seek clarification on the matters raised above.

Tunnel Options

2.12 In 2010, the Government signalled the possibility of funding being made available to locate Buckle Street in a tunnel, which led to a range of tunnel options being explored as part of the project. A total of eight tunnel options were considered, referred to as Option F to Option M. The cheapest tunnel option that provided a tunnel in front of the Basin Reserve was found to be over \$100 million more expensive than Option A, yet produced almost no additional benefits. On this basis the NZTA concluded that funding for any tunnel option could not be justified.

2.13 Following the Government announcement that Buckle Street would be located beneath the proposed National War Memorial Park in time for the Gallipoli centenary commemorations in 2015, the project team undertook further detailed assessment of Option A and F assuming that the Buckle Street underpass would be in place. The assessment followed a similar process to that used to assess the initial options.

2.14 The assessment concluded that Option F offered advantages over Option A in respect of Air Quality, Built Heritage and Visual criteria, while Option A offered advantages in terms of CPTED, Social and Transport outcomes. The assessment considered both options had identical impacts in terms of Archaeology, Noise, Urban Design and Vibration criteria.

2.15 The comparison of Option A with Option F then follows a process of consolidating the evaluation criteria down to four key criteria where the difference between options is greatest, as shown in **Table 2.4**.

Table 2.4 Simplified Option Matrix for Preferred Option and Option F

Evaluation Criteria	Option A		Option F	
Built Heritage	Moderate Negative	-4	Moderate Positive	4
CPTED	Significant Positive	6	Moderate Positive	4
Transportation	Substantial Positive	8	Moderate Positive	4
Townscape / Visual	Moderate Negative	-4	Moderate Positive	4
Total		6		16

2.16 Table 2.4 shows that Option A has moderate negative outcomes in respect of Built Heritage and Visual impacts and significant positive outcomes in respect of CPTED and Transport impacts. In comparison Option F has moderate positive outcomes against all four criteria. TR19 contains a very brief discussion comparing the options pointing out the positive and negative aspects of Option F. It does not present an explicit conclusion regarding which option is preferred overall, although it is implicit that Option A is preferred.

2.17 In the opinion of the reviewers, Option F provides better overall outcomes to Option A in respect of the criteria it has been assessed against. However, it appears that Option F has not been selected on the basis of it being too expensive to construct.

2.18 While the reviewers acknowledge that cost is a very important consideration in the evaluation of any project, the weighting assigned to this factor does not appear to be consistent with the approach used to identify Options A and B as being preferred to Options C and D in the evaluation of the initial options. In that instance, the assessment concluded that a difference in BCR of circa 0.5 was insignificant for a project of this scale. Whilst the reviewers do not share this view, the difference in BCR between Option A and Option F is likely to be of this magnitude given the additional costs of Option F and the similar level of benefits generated by each option.

2.19 **The apparent inconsistency and lack of transparency in the underlying process by which options have been compared at different stages of the project is a significant concern of the reviewers.**

2.20 TR19 also includes a detailed assessment of Option X, a concept developed by The Architecture Centre in 2011. The reviewers agree with the conclusion that Option X should not be considered the preferred option.

Cost of Options

2.21 Indicative costs are shown within TR19 for each of the options considered. In some cases options have been discounted due to their high construction costs. The breakdown of the cost estimates for Options A, F and X are provided in Appendix C of TR19. However, within the EPA application documents there is no detailed information provided to demonstrate how the indicative summarised costs were calculated. Whilst it is beyond the scope of this peer review to determine whether the estimated construction costs for each of the options have been calculated in an appropriate and equitable manner, it is important that a robust approach to calculating costs has been followed particularly given that some options have been dismissed on the basis of construction cost alone. A separate peer review may have been undertaken in relation to this but it is not evident within the application documents. We recommend that a

peer review of the construction costs is completed if one has not already been carried out.

Traffic and Transport Assessment

2.22 The following commentary on aspects of TR4 follows the same order as that presented in TR4. The sub-headings below reflect the corresponding Chapter names used in TR4.

Chapter 3: Transport Assessment Tools

2.23 The land use assumptions for the 2021 assessment year include additional demands on the network caused by consented activities. These are assumed to be accommodated for through the medium growth scenario. *“Additional demands however have been added onto the network for activities within the immediate Project area, such as the Rugby Street Supermarket, as sensitivity testing”².*

2.24 The reviewers note that the Rugby Street New World supermarket is a consented development, while the John Street Countdown supermarket and the ASB Sports Centre are built and operational. The reviewers consider it would be more appropriate for these developments to have formed part of the future 2021 environment against which the options were assessed and not just be included as a sensitivity test.

2.25 Section 9.3.3 Table 4-39 shows that these activities in combination with the Adelaide Road growth node have the potential to generate significant additional traffic movements in the project area and reinforce the reviewers’ stance that these conditions should have been included in the future 2021 environment.

2.26 The reviewer’s opinion is consistent with the NZTA guidelines that the receiving environment (beyond the subject site) is the environment upon which a proposed activity might have effects. It is permissible (and often desirable or necessary) to consider the future state of the environment upon which effects will occur, including:

- The future state of the environment as it might be modified by the utilisation of rights to carry out permitted activities;
- The environment as it might be modified by the implementation of resource consents that have been granted at the time a particular application is considered, where it appears likely that those resource consents will be implemented, but not; and
- The environment as it might be modified by the implementation of future resource consent applications (because these are too speculative).³

2.27 The status of the transport initiatives, shown in Table 4-1 of TR 4, which are included as part of the Do Minimum models, have been checked to ensure these accurately reflect the baseline against which the results are reported. While the timing of some projects have changed, the reviewers conclude that the overall package of Do Minimum improvements provides a suitable reflection of the transport infrastructure changes likely to be in place by 2021.

² Basin Bridge Project, Technical Report 4, Assessment of Traffic and Transportation Effects, Section 3.3.2

³ Abley, S, Durdin P, Douglass M (2010) Integrated Transport Assessment Guidelines, NZ Transport Agency Research Report 422

Chapter 4: Assessment Criteria

- 2.28 There are two international best practice documents used as part of the assessment which have since been superseded, these include:
- Transport assessment best practice. Guidance document. May 2006 (Transport for London)
 - Transport Assessment and Implementation: A guide, August 2005 (Scottish Executive Development Department)
- 2.29 Although these have been superseded it is not considered that this will have any significant effects on any of the outcomes or proposals as part of TR4.
- 2.30 Under the Statutory Considerations sub-heading, the Regional Land Transport Programme (RLTP) 2009-2012 is referenced. This has since been superseded by the RLTP 2012-2015. One of the main differences between the two documents is that a number of the projects surrounding the Basin Reserve, such as the Mount Victoria Tunnel Duplication, as well as the Basin Bridge Project, increased in priority in the RLTP 2012-2015. The changes only improve alignment between the project and the strategic direction of the RLTP.

Chapter 5: Baseline

- 2.31 Comparison of the base model traffic flows 2009 and the Do Minimum Traffic Flows 2021 (Figure 4-40 and 4-41) show no peak hour growth through the Mount Victoria Tunnel. This indicates that this part of the network is operating at capacity in peak hours; however it is unclear to what extent this is a function of the side friction imparted by the tunnel or the capacity constraints of the Dufferin / Paterson intersection.
- 2.32 The assumed link capacities are provided for the at-grade road, the Mount Victoria Tunnel and grade separated lanes. These capacities appear to be somewhat higher than expected. For example, the Mount Victoria tunnel is considered to be operating at capacity and according to the surveyed turning movements (published in Appendix A of Appendix 4-B) the peak direction flow is approximately 1450 vehicles per lane per hour. Urban mid-block capacities are generally expected to be in the order of 900 to 1400 vehicles per lane per hour (based on section 5.2 of Austroads Part 3) depending on the network operating conditions and the road environment. A reference to the source of the capacities quoted in Table 4-18 of TR4 should be provided, with justification to demonstrate their suitability.
- 2.33 In section 5.7.7 of TR4, it is mentioned that “*LOS of intersections has been assessed by queue lengths and journey times*”, with results published in section 5.7.9 on TR4. Intersection LoS is most usually calculated by the level of delay experienced by users of the intersection. Whilst intersections delays can be difficult to isolate in a congested system where links are also operating near or at capacity, it is also difficult to specify queue lengths where often a rolling queue is evident. To ascertain the robustness of this approach, it would be useful to understand:
- Justification of using queue length in preference to delay as a measure of LoS;
 - The maximum queue lengths considered to be acceptable; and
 - Where blocking back may be occurring between adjacent intersections.
- 2.34 The published journey times from Table 4-19 in TR4 have been converted into network operating speeds in **Table 2.5**. This has been undertaken to check that the calculated

journey times are of reasonable order and to understand the variance between modelled operating speeds and the posted speeds in the vicinity. The reviewers conclude that the modelled speeds are in a sensible range and reflect significant congestion across much of the network especially in the tidal flow direction during peak periods.

Table 2.5 Do Minimum Journey Speeds on Selected Routes for 2021 Peak Periods

	Route	Length (km)	AM		IP		PM	
			Time (Sec)	Speed (Km/h)	Time (Sec)	Speed (Km/h)	Time (Sec)	Speed (Km/h)
1	SH1 EB	4.19	468	32	378	40	492	31
2	SH1 WB	4.18	841	18	381	39	751	20
3	Kent Terrace to Adelaide Road	1.57	238	24	222	25	273	21
4	Adelaide Road to Cambridge Terrace	1.59	305	19	208	28	238	24
5	Adelaide Road to Taranaki Street	1.2	295	15	146	30	241	18
6	Tory Street SB	0.28	36	28	34	30	38	27
7	Tasman Street SB	0.21	24	32	23	33	23	33
8	Tasman Street NB	0.21	26	29	31	24	29	26
9	Tory Street NB	0.28	61	17	63	16	52	19
10	Taranaki Street SB	1.12	157	26	167	24	216	19
11	Taranaki Street NB	1.12	219	18	192	21	187	22
12	Brooklyn Road to Willis Street	1.15	354	12	233	18	358	12

- 2.35 In Section 5.9. Accessibility, details are provided in relation to the school travel patterns and school drop off area. There is no mention or details provided for Wellington High School which is located off Taranaki Street and has a school role of 961 pupils. There are no details provided for the University either which is located to the west of the Basin Reserve. As there are two points of pedestrian access to the University from Tasman Street it would be beneficial to understand what pedestrian demand may exist at these points and how this demand interacts with the proposed Basin Bridge project.
- 2.36 It is unclear what the staff travel patterns are for most of the schools and if parking is provided on-site for them or if they park in areas surrounding the Basin Reserve. The Mount Cook School in a bid to reduce congestion encourages parents to use *“the area to the south of the school adjacent to the vacant lot that will become part of the Memorial Park in the near future”*.⁴ The reviewers question whether any consideration

⁴ Basin Bridge Project, Technical Report 4: Assessment of Traffic and Transportation Effects, Section 5.9.1

has been given as to what may happen when this area is no longer available and if this is likely to cause any issues at the Tory Street / Buckle Street intersection?

- 2.37 As stated in Section 5.9.3 of TR4 the intersection analysis carried out in 2012 for the Pirie / Kent / Cambridge / Vivian intersection forecast queue lengths to be as long as 130m on Pirie Street in the AM and PM peak periods. This does not match with the queue lengths shown for Pirie Street in Tables 4-26 / 4-27 on page 116/117 of TR4 which show queue lengths of up to 7 vehicles in the Do-Minimum morning peak period and 6 vehicles in the evening peak period. Based on an average queued vehicle length of 7 metres (vehicle length plus space between queued vehicles) this corresponds to modelled queues of 40-50 metres which is significantly less than that stated in Section 5.9.3 of TR4.

Chapter 7: Assessment of Effects

- 2.38 The comments relating to the assessment of effects are addressed by TR4 Chapter sub-headings in the following sections.

Chapter 7.1: Pedestrian and Cyclist Assessment

- 2.39 Overall, is it agreed that the provision of pedestrian and cyclist facilities is improved by the project with the inclusion of the shared path to the northern side of the Basin Bridge as well as the upgrade to and provision of new facilities. The main changes to the pedestrian and cycling network occur to the north, east and south of the Basin Reserve.
- 2.40 In Figure 4-57: Proposed Pedestrian and Cycle Facilities on-road cycle facilities on both sides of Ellice Street from the church entrance to the intersection with Brougham Street are indicated. An on-road cycle route is also shown on Brougham Street from the intersection with Ellice Street to where it joins the elevated shared path. However, these on-road cycle facilities are not shown on the corresponding drawing 'Proposed Walking and Cycling Paths' Sheet No. 4C.02 where only pedestrian footpaths are indicated. Further clarification as to what is proposed in this area should be provided.
- 2.41 Whilst the project upgrades existing facilities and provides new facilities to the north, east and to a certain extent to the south, there is almost no provision to the west of the reserve in terms of cycle or shared paths or crossing facilities for pedestrians / cyclists. Cyclists travelling northbound on Adelaide Road who then wish to head west would be required to travel through the Basin Reserve coming out onto the shared area and use the crossing on Cambridge Terrace before continuing westbound through the War Memorial Park. This is a circuitous route compared to following Rugby Street and Sussex Street and is unlikely to appeal to all cyclists. The reviewers observe that the provision for cyclists on the western side of the Basin Reserve is not ideal.
- 2.42 The new pedestrian and cyclist shared facility from the Mount Victoria Tunnel to the Buckle / Tory intersection will provide a direct east – west link. However from the pedestrian interception surveys carried out in 2012 as detailed in Section 5.4.3 of TR4, it is unclear what, if any existing pedestrian or cyclist demand exists in this direction. The results of the survey show that demand is primarily in the north – south direction rather than east – west. Further information is required to support the assumed demand of 625 trips during a weekday and 299 trips on a weekend for the bridge⁵.
- 2.43 Section 7.1.3 of TR4 also assumes that pedestrian and cyclist demand “*is forecast to grow at 2% per annum*”. However this does not match with Mr Dunlop’s evidence which provides information obtained from the WCC Transport Monitoring Surveys

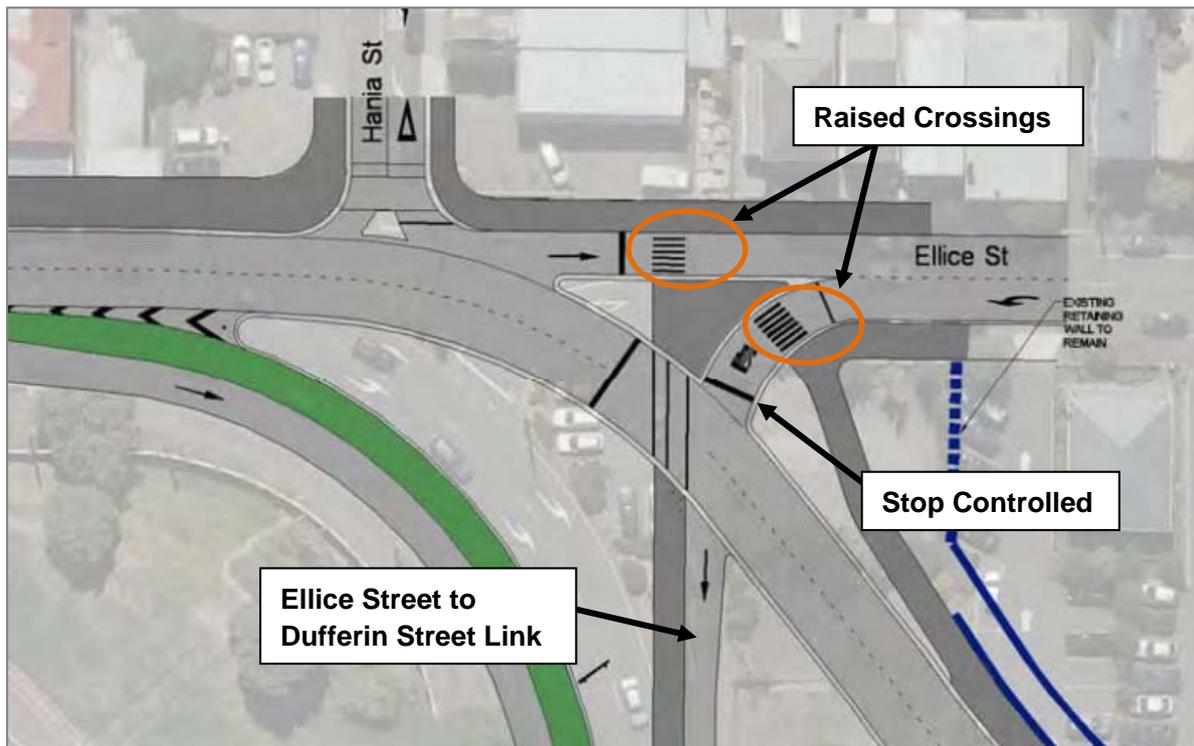
⁵ Basin Bridge Project, Technical Report 4: Assessment of Traffic and Transportation Effects, Section 7.1.3

(2009 – 2013) that show a 62% increase over a five year period for cyclists at the John Street intersection (which may in part be due to the Countdown supermarket opening in the interim) and 123% increase over a five year period for pedestrians at the crossing of Buckle Street west of the Basin Reserve.

- 2.44 It is unclear if there is a particular reason for these significant increases. For example, if the increase in cycling demand at the John Street intersection is due in part to the opening of the Countdown supermarket then this may suggest a similar increase could occur on Rugby Street where the consented New World supermarket is to be built. If the future pedestrian and cyclist demand follows the trend shown in the WCC Transport Monitoring Surveys rather than the predicted 2% then potentially the pedestrian and cyclist facilities could be insufficient or under-designed.
- 2.45 The evidence of Mr Dunlop also states that pedestrian and cyclist movements could “...double following the duplication of the Mt Victoria tunnel and associated improvements to the existing poor cycle and pedestrian facilities linking the south east”⁶. This, in combination with the recent large observed increases in pedestrian activity in the general vicinity of the project, raise some questions over the suitability of the design of the proposed shared path facility. The reviewers consider the suitability of the 3m wide shared facility should be reviewed in light of the potential significant increases in walking and cycling activity that may eventuate over that currently experienced. Of particular interest to the reviewers is the large speed differential that may exist on the ramp between cyclists travelling downhill and other users, and the lack of escape route for users travelling too fast to avoid a collision.
- 2.46 Section 7.1.9 of TR4 indicates that the proposed Ellice Street raised crossings shown in **Figure 2.1** will consist of a raised platform zebra crossing with adjacent drop kerbs implemented for cyclists. The reviewers are concerned that locating a pedestrian and cyclist crossing facility adjacent to each other where in one instance pedestrians have priority over vehicles and cyclists have to give way to vehicles is a complex and confusing arrangement that is likely to result in poor safety outcomes. The reviewers consider this arrangement should be revisited.

⁶ Statement of evidence of David James Dunlop for the New Zealand Transport Agency (Transportation), Section 10.84

Figure 2.1 Hania / Ellice Street Intersection Layout



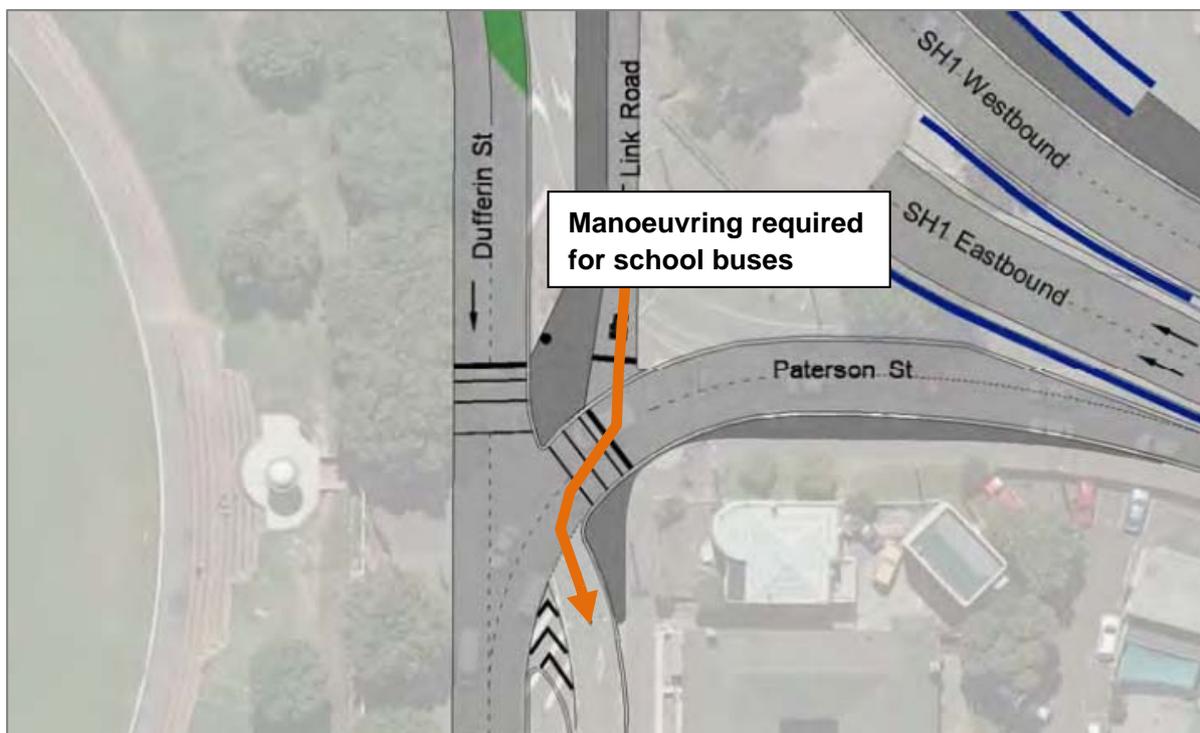
Chapter 7.7: Safety Assessment

- 2.47 The preferred option has been subject to a Safety Audit by Traffic Planning Consultants Limited. The audit raises a number of safety concerns with the project of which one matter was deemed serious and four matters deemed to be significant. Following the provision of further information, three addendums to the original safety audit identified five further significant concerns. The reviewers agree with the findings of the safety audit. While it is acknowledged that any project that is retrofit into an environment with a number of constraints cannot be entirely free of safety issues, the reviewers consider that all serious and significant issues must be designed out of the project to minimise the risk of future safety problems manifesting.
- 2.48 In addition to the safety issues identified in the safety audit report, the reviewers are uneasy about the design of the Link Road between Ellice Street and Paterson Street. Our primary reservations relate to the safety of vehicles accessing the Link Road from Ellice Street and exiting the Link Road onto Paterson Street. TR4 appears to be contradictory in identifying the type of controls that traffic entering and exiting the Link Road will be subject to. Section 7.3.6 of TR4 and the s-Paramics model show these movements as being priority controlled (i.e. not signalised) yet Section 7.8.5 identifies that the Link Road will be controlled with traffic signals despite Figure 4-86 clearly showing the movements are Stop controlled. The following comments are made on the basis that traffic undertaking these movements will do so via a Stop control.
- 2.49 At the Ellice Street end, it is possible that pedestrians waiting to cross SH1 eastbound will obscure visibility for traffic attempting to access the Link Road from Ellice Street. Given the high volumes of traffic on the SH1 eastbound link, it is expected that traffic performing this movement will experience lengthy delays leading to greater risk taking behaviour. The proximity of the roadway to a shared use path may further complicate the already complex situation as pedestrians may move into the path of a vehicle attempting to enter the Link Road which results in the driver having to either stop

across SH1 eastbound or swerve to avoid the pedestrian. Neither situation can be considered acceptable from a safety perspective. The reviewers consider the movement should be signalised and operate in conjunction with the pedestrian crosswalk.

- 2.50 At the Dufferin / Paterson end of the Link Road shown in **Figure 2.2**, traffic has to give way to traffic approaching from Paterson Street. This means traffic exiting the Link Road will be focussed on traffic arriving from the left. Upon identifying a suitable gap it is possible that a driver may move off the limit line and into the intersection without recognising the current phasing of the signals on Patterson Street. Given the proximity of the Link Road to the intersection and in particular the pedestrian crosswalk that provides access to the schools, the reviewers are concerned that this creates a potentially unsafe situation. Again, it is recommended that the Link Road is signalised and incorporated into the operation of the intersection. Alternatively, the Link Road should intersect Paterson Street further from the Dufferin Street intersection.

Figure 2.2 Paterson Street / Dufferin Street intersection layout

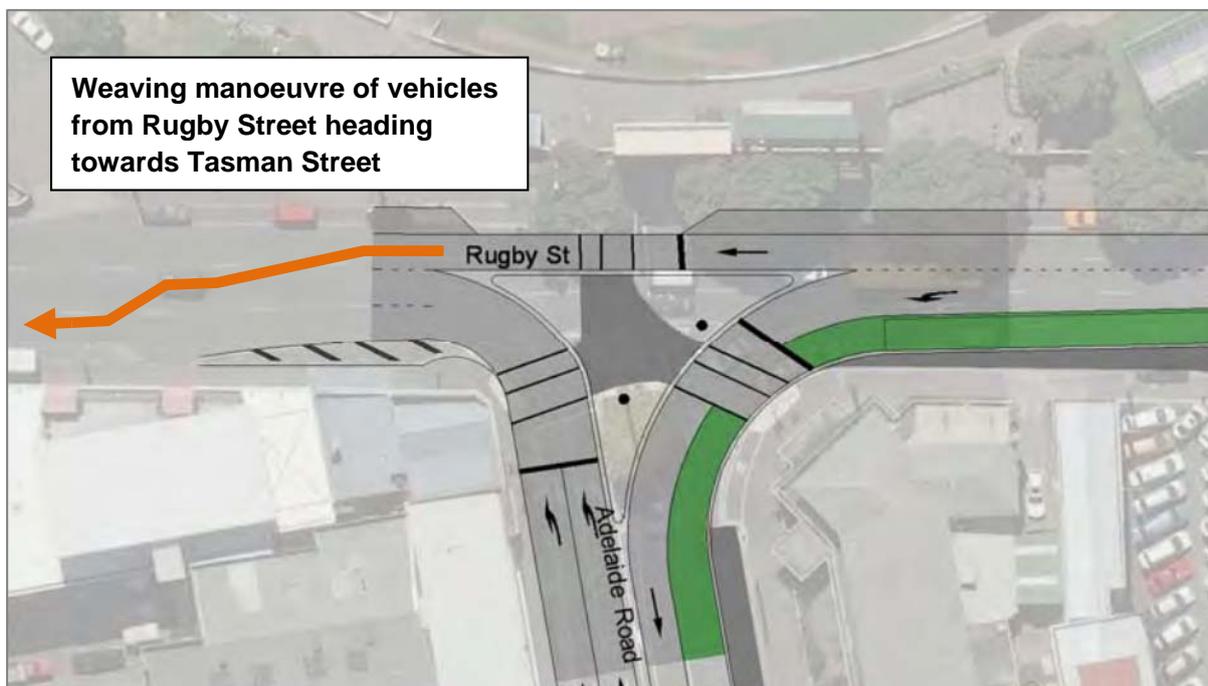


Chapter 7.8 Accessibility Assessment

- 2.51 The proposed school bus parking area as detailed in Section 7.8.2, located to the south of Rugby Street, is much smaller compared to the existing facility where buses pick-up / drop-off. The existing area is 50m long compared to the proposed area which is 20m in length. Further details are required to demonstrate that there will be sufficient capacity to accommodate the number of school buses required to service the nearby schools.
- 2.52 Section 7.8.5 also indicates that the Link Road “...is not expected to be a preferred route and become a rat run for Mount Victoria residents due to how the signals will be programmed and operate.” Observation of the s-Paramics model shows a moderate number of vehicles perform this movement and as such does not appear to support the statement about its intended use. Further information is requested to support the statement regarding the use of the Link Road and the physical measures implemented to achieve this. Comparison against alternative routes would be helpful.

- 2.53 Given the scale of these flows, the aforementioned issues regarding the unsuitability of Stop controls at the intersections become increasingly important with regard to safety issues that need to be addressed.
- 2.54 Section 7.3.6 of TR4 states “Currently some buses that service Wellington East Girls College service other schools or stops in the area. A number of these buses will access the Basin Reserve via Ellice Street to continue their journey. The link road will provide access for these buses to continue journeys as they are now scheduled with improved safety for buses and passengers”. The configuration of the Paterson Street/ Dufferin Street / Link Road intersection as shown in Figure 2.2 does not easily lend itself to the manoeuvring of buses from the link road through the intersection and into the bus pick-up / drop-off area. This is further complicated by the fact that the buses will have to cross over two lanes of traffic at the signals.
- 2.55 The intersection of Rugby Street and Adelaide Road currently operates with three approach lanes on Rugby Street. However, the project proposes to narrow this down to one lane as shown in **Figure 2.3**. The turning movement survey data reported in Appendix A to TR4 Appendix 4-B, has identified currently between 30 – 65 vehicles per hour travel westbound on Rugby Street past Adelaide Road and exit at the left hand lane of Rugby Street heading toward the Tasman / Rugby intersection.
- 2.56 In order to undertake the same movement with proposed layout shown in Figure 2.3, these vehicles would need to weave across two lanes of traffic over an 80 metre segment. The reviewers are concerned that this is a potentially dangerous weaving situation that may be exacerbated by the two lanes and one lane of traffic from Adelaide Road and Rugby Street respectively being discharged at the same time following the shared pedestrian / cycle phase.

Figure 2.3 Rugby Street / Adelaide Road intersection layout



Chapter 7.9 Construction Assessment

- 2.57 A review of the draft Proposed Construction Transport Management Plan submitted as part of the Management Plans supports the details in Section 7.9 of TR4 and applies

best practice to the policies and procedures and methodologies that will be put in place in order to minimise the impacts of the Temporary Traffic Management.

- 2.58 Section 7.9.1 of TR4 sets out the assumed construction sequencing of the project at a macro level. The change in journey times has been modelled for different routes through the Basin Reserve during Stage 3 of the project, when lane capacity on Paterson Street is reduced to one lane on the approach to the Dufferin / Paterson intersection. This shows westbound traffic will be mainly affected with 118 seconds of additional travel time during the PM period and lesser amounts in the AM and IP periods. While this level of delay is substantial, it is acknowledged that this does not take into account any re-routing which may occur, which is likely to reduce apparent delays.
- 2.59 Overall, the reviewers are satisfied that there is an appropriate plan in place to manage the effects of the project during the 34 month construction period.

Assessment against the Wellington Regional Land Transport Strategy 2010-40 (RLTS)

- 2.60 The assessment of the project against the Wellington Regional Land Transport Strategy 2010-40 is covered within Section 7.11. This provides a summary of the RLTS outcomes, targets and how the Project aligns with these key actions. However the reviewers note that there are a number of outcomes which are not specifically addressed in Table 4-30 of TR4, as follows:
- (3.2) Reduced private car mode share;
 - (3.4) Increased private vehicle occupancy;
 - (4.3) Improved reliability of the strategic roading network;
 - (6.1) Improved land use and transport integration (in line with the WRS and local authority urban development strategies);
 - (6.2) Improved integration between transport modes;
 - (6.3) Sustainable economic development supported (in line with the WRS); and
 - (7.2) Improved inter regional freight efficiency.
- 2.61 The evidence of Mr Dunlop addresses (6.1), (6.2) and (6.3) but this still leaves (3.2), (3.4), (4.3) and (7.2) as not being specifically addressed in the project documentation.
- 2.62 The reviewers acknowledge that the project will generally contribute to positive outcomes in relation to (4.3), (6.2) and (7.2). While consistency of the project with (3.2) is debateable, reducing private car mode share is not intrinsically related to any of the overall project objectives and so no further action is considered necessary.

Chapter 9: Future Proofing and Sensitivity Tests

- 2.63 The Wider Strategy discussion in Section 9.1 of TR4 states that “*the PT Spine Team are currently in the process of short listing options and testing the impact of three different options*”. This has now been completed and has gone out to consultation. The three options evaluated were Bus Priority, Bus Rapid Transit (BRT) and Light Rail Transit (LRT). The Regional Transport Committee have agreed the preferred option to be BRT (subject to consultation). The submissions and hearing in relation to the Passenger Transport Spine are due to be heard in December 2013.
- 2.64 An update is requested following completion of the PT Spine testing using the Wellington Regional Transport Strategy Model (WTSM) and further details provided relating to the changes in Passenger Transport and vehicle demands through the project area.

Summary

2.65 Following a detailed review of TR4, the reviewers have considered the extent to which the preferred option has met the objectives:

a) To improve the resilience, efficiency and reliability of the State highway network:

- ***By providing relief from congestion on State Highway 1 between Paterson Street and Tory Street***

The report demonstrates substantial journey time savings and a reduction in traffic volumes through this section of State Highway 1.

- ***By improving the safety for traffic and persons using this part of the State Highway 1 corridor;***

The reduction in traffic volumes may reduce the number of crashes although there is still the issue relating to weaving across lanes on Buckle Street.

- ***By increasing the capacity of the State highway corridor between Paterson Street and Tory Street***

The grade separated westbound link will increase the capacity of the corridor.

b) To support regional economic growth and productivity:

- ***By contributing to the enhanced movement of people and freight through Wellington City;***

The improved journey times on the State Highway and removal of much conflict between local road and State Highway traffic will assist in the achievement of this objective.

- ***By in particular improving access to Wellington's CBD, employment centres, airport and hospital.***

The improved journey times on the State Highway and removal of much conflict between local road and State Highway traffic will partly assist in the achievement of this objective. It is acknowledged that the project enables duplication of the Mount Victoria Tunnel to occur and it is that project which will more significantly contribute to achievement of these objectives.

c) To support mobility and modal choices within Wellington City:

- ***By providing opportunities for improved public transport, cycling and walking:***

The implementation of the bus lanes will enhance the public transport service through the Basin Reserve.

The shared pedestrian and cyclist facility to the northern side of the bridge will improve links between the Mount Victoria Tunnel and Buckle Street. There are additional and improved pedestrian and cyclist facilities provided at grade, including improved crossing facilities. However the links to the western side of the Basin are limited.

- ***To facilitate improvements to the local road transport network in Wellington City in the vicinity of the Basin Reserve.***

There are a number of improvements to the local road transport network included as part of the project.

2.66 Overall, it is concluded that the preferred option generally meets the project objectives.

3 TRANSPORT MODELLING REVIEW

Introduction

- 3.1 The transport modelling review has been undertaken in parallel with the traffic and transport assessment and focuses on the modelling inputs, methodology and outputs presented in the EPA documents. The key documents that have been reviewed are:
- Technical Report 4: Assessment of Traffic and Transportation Effects; and
 - Technical Report 19: Alternative Options Omnibus.
- 3.2 The s-Paramics modelling files have been supplied so the network coding can be checked against the Basin Bridge scheme design. A comprehensive review of the modelling files has not been undertaken as the model has already been approved through an independent peer review process.
- 3.3 The transport modelling review of Technical Report 4 focuses on the main body of the document and the following Appendices:
- 4-B Wellington CBD s-Paramics Model Validation Report;
 - 4-C Technical Note 29: Demographic Inputs to WTSM;
 - 4-G Network Flow Diagrams and Network Statistics;
 - 4-I Pirie/Kent/Cambridge/Vivian Intersection Memorandum; and
 - 4-J s-Paramics Model Outputs.

Use of Transport Models

- 3.4 Four levels of models have been applied in this assessment:
- Wellington Regional Transport Strategy Model (WTSM);
 - Wellington SATURN Model;
 - Wellington s-Paramics Model; and
 - Individual intersection modelling using Sidra Intersection.
- 3.5 The application of multiple levels of transport modelling tools with increasing levels of detail in the vicinity of the project is standard practice for assessing the impacts of schemes with a similar size and complexity of the Basin Bridge project. The four transport models listed above will be referred to as WTSM, SATURN, s-Paramics and Sidra respectively in the remainder of this review.
- 3.6 The WTSM is a strategic regional model and has been used to calculate demand matrices which are then passed down to calculate demand for the more detailed SATURN and s-Paramics models. In section 3.2.1, TR4 mentions that the WTSM has a base year of 2006 and was being updated to a 2011 base model but that these updated models were not available to complete this assessment. The report goes further to say that *“As an interim measure, GWRC have rebased the 2006 WTSM model to 2011 trip demands and forecast years of 2021 and 2031.”* It would be useful to understand what limitations and/or risks (if any) have been introduced by assuming an interim model rather than progressing with a fully updated model.
- 3.7 In section 3.2 of TR4 it is stated that *“the WTSM, SATURN and s-Paramics models meet NZTA’s validation criteria and have been subject to external peer review”*. Later in this section we provide commentary on the level of calibration and validation of each of these three transport models. The intention here is not to revisit the previous

external peer reviews but instead to determine whether there is sufficient evidence in the EPA documentation to demonstrate that the models have been approved by the peer reviewers, and are fit for the purpose of assessing the impacts of the Basin Bridge project.

Roles of Models and Modal Split

Role of WTSM Model

- 3.8 The WTSM is a four-stage strategic model and has been used to provide vehicle trip matrices for the more detailed SATURN model. In section 3.2.1 of TR4 it is specified that within the WTSM *“the mode choice models are not sufficiently detailed to forecast the number of pedestrian and cyclists using the streets around the Basin Reserve. Therefore, this is generally forecast manually on the basis of trend analysis and professional judgement.”*
- 3.9 An appropriately calibrated four-stage model will be capable of forecasting the quantum of person trips that assume each mode of transport, as the various modes compete for trips (based on the generalised cost of travel) within the modal split stage of the model. It is anticipated that some degree of forecasting pedestrian and cycle demand should be available on a study area wide basis within the model, although not at such a fine grain level as to be specific to the streets surrounding the Basin Reserve. Subsequently, it is agreed that it is reasonable to forecast the growth of pedestrian and cycle trips in the vicinity of the Basin Reserve based on trend analysis and professional judgement.
- 3.10 Section 3.2.1 of TR4 mentions that at the time at which the ITA was being prepared, a more detailed public transport model was being built, however no additional information is provided as to the nature or extent of the improvements being made to the public transport model. The WTSM has been used to directly report bus passenger volumes on key corridors in Section 5.5.3 of TR4. This is the appropriate model platform for reporting passenger volumes, however some commentary to understand any limitations would be helpful.
- 3.11 The reporting in TR4 does not include any reference to the WTSM being used to model the impact of the Basin Bridge project on passenger transport patronage numbers. It is plausible that the improved passenger transport travel times (discussed in section 7.2 on the TR4) may be partly or wholly offset by improved travel times for private vehicles, as private vehicular travel becomes more attractive.

Role of Saturn Model

- 3.12 The SATURN model has been used to assign the WTSM vehicular demand and assess route choice in the vicinity of the Basin Reserve. The model makes provision for passenger transport only as far as including buses within the vehicle demand matrices and does not calculate patronage numbers or make provision for modelling active modes.
- 3.13 The SATURN model has been run at 2009, 2021 and 2031, is used to assess the changes in traffic flows due to the Basin Bridge project, and to understand the impact of a range of sensitivity tests. The SATURN output trip matrices are then supplied as demand inputs for the more detailed Wellington s-Paramics model.
- 3.14 An additional performance indicator derived from SATURN model outputs is link Level of Service (LoS) as a measure of the volume/capacity ratio of each road link, using HCM LoS boundary criteria and link capacities. Intersection LoS is based upon s-Paramics modelled queue lengths and journey times.

- 3.15 Network flow diagrams and key network statistics are also reported in TR4 Appendix 4-G directly from the SATURN model. Morning peak, interpeak, evening peak and Average All Day Traffic (AADT) flows by direction are included for each modelled scenario. A comprehensive coverage of modelled flows are provided from Cobham Drive in the east to the Terrace Tunnel in the west. The key statistics reported in Appendix 4-G include measures of delay, travel time, distance, speed, vehicle queues, travel demand and fuel consumption. The reporting of network flows and statistics does not isolate light and heavy vehicle volumes, but instead reports on the entire vehicle fleet.

Role of s-Paramics Model

- 3.16 The Wellington CBD s-Paramics model has been used to model the complexities of traffic operation in the vicinity of the Basin Bridge project. According to section 3.2.3 of TR4 it is “*the primary traffic engineering design tool for the detailed analysis*”. Similar to the SATURN model, provision for passenger transport is made only so far as including buses within the vehicle demand matrices. S-Paramics does not calculate patronage numbers or make provision for modelling active modes; however, s-Paramics is capable of enabling detailed modelling of bus lanes, other bus priority measures and operation in the vicinity of bus stops.
- 3.17 S-Paramics modelling has been undertaken at the base year of 2009 and 2021, and a model validation report with accompanying peer review has been included as Appendix 4-B to TR4. The reporting of modelled traffic volumes throughout TR4 focuses on SATURN modelling, whereas reporting of journey times and intersection operation focuses on s-Paramics modelling.
- 3.18 Journey times for both passenger transport and general traffic have been derived from s-Paramics model outputs and referenced throughout TR4, and maximum queue lengths in morning and evening peak periods have also been extracted at key intersections. S-Paramics has also been used to model the travel time effects of the assumed three-stage construction sequencing, although only a limited quantity of analysis of model outputs is provided.

Role of Sidra Intersection Analysis

- 3.19 According to Section 3.2.4 of TR4 “*Sidra was used to model and assess the performance of individual intersections since SATURN and s-Paramics model outputs cover a wider network and therefore the performance of individual intersections cannot be determined according to measurable statistics.*” The sole reference to the application of Sidra is in Appendix 4-I to TR4 where a range of intersection options for the Pirie/Kent/Cambridge/Vivian intersection are assessed. Sidra is considered to be a suitable tool for this assessment.

Inputs and Assumptions

- 3.20 The model inputs and assumptions can be categorised as relating to:
- Land use;
 - Road network;
 - Provision for other modes; and
 - Model parameter settings.

Land Use

- 3.21 The base year and future year land use inputs and assumptions are documented extensively in Appendix 4-C of TR4. A peer review letter prepared by Dr. John Bolland (John Bolland Consulting Ltd) dated 31st March 2013 included with Appendix 4-C states that the 2011 forecasts prepared “*were the best available in the absence of the Census*”. Dr. Bolland also endorses the development of the future land use scenarios. Subsequently this review has not re-visited Dr. Bolland’s analysis but has instead focused on checking the currency of the underlying forecasts.
- 3.22 The quantum of growth appears to be reasonable with the demographic analysis included in Section 5 of TR4 being largely consistent with expectations. It is noted that Statistics New Zealand have published revised population forecasts in October 2012, however these are not dissimilar to those presented in TR4. Further to this, the medium growth projections are in line with historical growth in Wellington City.
- 3.23 Sensitivity tests undertaken include an additional demand scenario which includes:
- Rugby Street New World Supermarket;
 - John Street Countdown Supermarket;
 - Adelaide Road growth node; and
 - ASB Sports Centre in Kilbrinie.
- 3.24 The Countdown Supermarket and ASB Centre are both built and operational, and the New World Supermarket is consented, and subsequently should be included in the transport modelling. It is unclear to what extent and when the Adelaide Road growth node may develop, therefore further information is requested in this regard. The results of the additional demand scenario may subsequently provide a more relevant picture of the future do-minimum and proposed project network performance.

Road Network

- 3.25 The do-minimum road network assumptions are specified in section 3.3.3 of TR4. All local road improvements were approved in 2011 and are appropriate for inclusion. The Buckle Street Underpass and associated Inner City Bypass (ICB) are currently under construction and should collectively be completed towards the end of 2014. The other NZTA works are not in the direct vicinity of the Basin Bridge project and are also considered to be appropriate.
- 3.26 The ICB improvements included within the do-minimum network are specified on page 14 of TR4 and are described as a ‘moderate intervention’ option. There are some key differences between the latest proposed improvements under construction (as specified in <http://www.nzta.govt.nz/projects/buckle-st-underpass/publications.html>) and the moderate interventions reported in TR4. Consideration should be given to the likely impact of these differences on the merits of the Basin Bridge project. The differences relate to intersection layout at:
- Willis / Karo intersection;
 - Cuba / Karo intersection; and
 - Taranaki / Arthur intersection.
- 3.27 The description of the proposed (with Basin Bridge Project) road network in TR4 is consistent with the design philosophy and road layout diagrams included with the application.

- 3.28 The modelling files corresponding to the s-Paramics 2021 do-minimum and proposed road networks have been reviewed, and the outcomes of this review are included later in this section of the report.

Provision for Other Modes

- 3.29 Provision for walking and cycling has not been modelled using any of the transport models utilised in this assessment. Base year demand has been determined through pedestrian and cycle surveys, and future demand is based on conservative growth rates. This approach (that is; not using conventional transport models to forecast demand) is not unusual.
- 3.30 Bus lanes have been included on Courtney Place, Kent Terrace, Cambridge Terrace and Adelaide Road. Seven bus services have been identified in Table 4-3 of TR4 as travelling through the Basin Reserve Gyrotory although it is noted that express service 32 between Wellington and Houghton Bay – The Esplanade is not included.
- 3.31 Patronage at key locations in the vicinity of the Basin Reserve are published from the WTSM model outputs. These are not directly compared to surveyed flows and there is little supporting detail to understand the underlying assumptions and parameter settings for the modelling of passenger transport.

Model Parameter Settings

- 3.32 There is little supporting documentation specifying model parameter settings for the WTSM and SATURN models used in this assessment. These details would normally be included in a model build/validation report and the appropriateness of these parameter settings may have been assessed in a separate peer review. Evidence that the WTSM and SATURN models have successfully passed a peer review is requested, and any significant changes in model operation and underlying assumptions post-review should be documented.
- 3.33 Appendix 4-B is a model validation report for the s-Paramics model and includes the findings of a peer review of the base year model conducted by Aurecon. The peer review findings are included within the Appendix and conclude that “the model is fit for use for its intended purpose”. The peer review findings did not isolate any significant concerns with regard to parameter settings.

Model Calibration and Validation

WTSM Model Calibration and Validation

- 3.34 The WTSM peer review letter is included at the end of Appendix 4-C to TR4. Dr. Bolland concludes that the WTSM update and development of the WTPM are broadly fit for purpose.
- 3.35 It is acknowledged that the inclusion of the outcome of Dr. Bolland’s review provides evidence that the underlying land-use forecasts for 2011 and future years are endorsed, however it is unclear from the whether the peer review is consistent with the version of the WTSM used in this assessment. Confirmation of this is requested.
- 3.36 Further information regarding the calibration of the mode split within the WTSM is of particular importance. Strong growth in public transport demand is demonstrated between 2011 and 2021 in Table 4-4 and Table 4-5 of TR4, which appears to be logical. There is a reduction (or no growth) in passenger transport demand between 2021 and 2031 in the morning and interpeak periods and continued growth in the evening peak period. Some commentary to justify these post-2021 trends would be

helpful to provide assurance that the modal split is calibrated appropriately for all periods.

SATURN Model Calibration and Validation

- 3.37 The SATURN model has been reported as meeting NZTA's validation criteria and has according to section 3.2 of TR4, has been peer reviewed. Evidence of the outcome and scope of the peer review is requested. Specifically; was the model approved as fit for the assessment of the Basin Bridge project, did the review cover both base and future year models, and does it review the process by which the WTSM output matrices are transformed to provide SATURN input matrices (for both base and future years)?
- 3.38 As no details are provided regarding the SATURN model traffic validation, a coarse validation check of traffic flows has been completed. A selection of traffic counts recorded on the 10th February 2009 in the vicinity of the Basin Reserve are available in Table 4-13 of TR4 with corresponding 2009 SATURN base model flows published in Figure 4-40. The results are shown in **Table 3.1**.
- 3.39 It is acknowledged that this validation check has some limitations as the modelled flows in Figure 4-40 of TR4 are rounded to the nearest 100 vehicles, no seasonal adjustment has taken place to match 10th February counts with a 'typical' base model period, and flows in the vicinity of Ellis Street have been calculated from survey data based on a combination of movements as specified in the reference column of Table 3.1.
- 3.40 These limitations notwithstanding, the SATURN model provides an appropriate representation of surveyed flows and generally meets NZTA's EEM validation criteria (refer to Worksheet 8.4 of EEM) as demonstrated by **Table 3.2**. The difference between surveyed and modelled flows is generally within 30% which further meets the EEM validation criteria for intersection flows. On this basis it is concluded that the SATURN modelled flows in the vicinity of the Basin Reserve are consistent with validation guidelines.
- 3.41 The SATURN model results will be sensitive to the extent to which the model reflects SH1 through movements in the vicinity of the Basin Reserve, especially in the westbound direction. Section 3.1 of TR4 mentions origin-destination surveys have been undertaken to support the assessment, and on page 6 of Appendix 4-I a number-plate survey is referenced to determine origins and destinations of vehicle movements around the Basin Reserve. It is not known whether this survey has been included in the SATURN model validation.

Table 3.1 SATURN Flow Validation Check

Reference	Movement	AM Peak (8-9am)			Interpeak (Noon-1pm)			PM Peak (5-6pm)		
		Survey	Model	GEH	Survey	Model	GEH	Survey	Model	GEH
1	Adelaide (S) left to Rugby (W)	980	1300	9.5	840	700	5.0	875	900	0.8
2	Rugby (E) left to Adelaide (S)	440	500	2.8	514	500	0.6	643	700	2.2
3	Rugby (E) through Rugby (W)	1716	1500	5.4	1134	1500	10.1	1338	1500	4.3
4	Paterson (E) left to Dufferin (S)	1459	1500	1.1	1137	1400	7.4	1267	1400	3.6
5,6,9,10-8	Kent (N) left to Ellice (E)	1934	2000	1.5	1841	1700	3.4	2228	2300	1.5
5,6,8,11,12-9,10	Ellis (E) to Dufferin (S)	1709	2100	9.0	1709	1800	2.2	2434	2600	3.3
7	Buckle (W) left to Cambridge(N)	957	900	1.9	643	700	2.2	873	1000	4.2
13	Sussex (S) left to Buckle (W)	1567	2000	10.3	1364	1400	1.0	1255	1500	6.6
14	Sussex (S) right to Buckle(E)	1202	900	9.3	641	800	5.9	809	1100	9.4

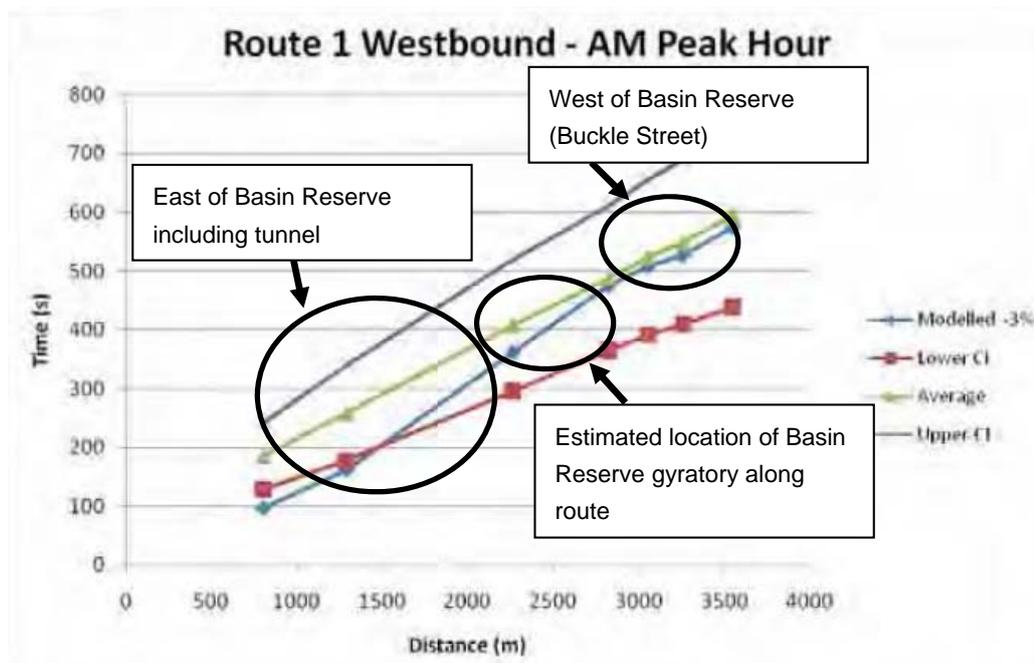
Table 3.2 Summary of SATURN Flow Validation

Criterion	Target	Model
Percentage with GEH < 12	100%	100%
Percentage with GEH < 10	95%	93%
Percentage with GEH < 5	60%	59%

S-Paramics Model Calibration and Validation

- 3.42 Appendix 4-B is a model validation report including a peer review for the s-Paramics model conducted by Aurecon. The peer review findings are included within the Appendix and conclude that *“the model is fit for use for its intended purpose”*. The scope of the review appears to only include an assessment of the suitability of the base year model, subsequently a full review of the base year calibration and validation of the model is not required. It is noted however that the peer reviewer points out that “according to the definition of “validation” in this audit, that no validation has been undertaken”. The inference is that all traffic data collected has been used to calibrate the performance of the model without checking the model validation with a separate set of traffic data inputs.
- 3.43 Modelled journey times and queue lengths are reported extensively throughout TR4, therefore the quality of the validation has been checked in the vicinity of the Basin Reserve. Turning movement count and screenline validation in the vicinity of the Basin Reserve are confirmed to be appropriate and provide excellent coverage across the study area.
- 3.44 Journey time validation is included on six routes with SH1 westbound and SH1 eastbound journeys being most critical to the Basin Bridge project. Within Appendix 4-B journey time validation meets DMRB criteria, and in Appendix B cumulative travel time plots demonstrate surveyed versus modelled times for each route and period.
- 3.45 The Route 1 westbound corridor from Evans Bay Parade to Willis Street circumnavigates the Basin Reserve approximately 2.2 - 2.8km along the route. It is evident from the Appendix B route 1 westbound plot in Appendix 4-B (presented here as **Figure 3.1**) that the slope of the average surveyed and modelled cumulative travel time at this location is very different. This is the section over which journey time benefits are realised, therefore it is critical that modelled times closely match surveyed journey times.

Figure 3.1 Route 1 Westbound AM Peak Cumulative Travel Time (from Appendix 4-B)



3.46 To provide confidence that journey times in the direct vicinity of the scheme are appropriately validated it is requested that Route 1 westbound journey time validation be disaggregated to isolate this critical section of the route (between the tunnel and Buckle Street).

3.47 Queue lengths have been collected at eighteen intersections, all situated to the west of the Basin Reserve. Of particular note is that queue lengths have not been collected at the Dufferin / Paterson and Rugby / Adelaide signalised intersections. These intersections are described in the TR4 Executive summary as a 'bottleneck' and 'congested' respectively. Subsequent reporting of 2021 do minimum queue lengths in Table 4-20 of TR4 at these intersections may not be entirely representative of future conditions as the base year model has not been checked. Queue length calibration at these two locations would be useful, however acknowledging that the modelled base year is 2009, it is not plausible to collect and apply this data retrospectively. A more detailed breakdown of the validation of journey times through these intersections would be sufficient to demonstrate that congestion is adequately reflected in the base models.

Sensitivity Testing

3.48 The sensitivity testing in TR4 reports do-minimum and proposed project traffic volumes from the SATURN model based on three alternate sets of demand input assumptions:

- 2031 medium growth;
- 2021 high growth; and
- Additional development (two supermarkets, growth node and sport centre).

3.49 In each instance the results are contrasted with the 2021 medium growth forecast traffic volumes, and full network flow diagrams for each period are included in Appendix 4-G. Key network statistics for the 2031 medium growth sensitivity test are also included in Appendix 4-G.

- 3.50 The 2031 medium growth scenario includes an approximate 9% growth in population, 4% growth in employment, and includes the duplication of Mount Victoria Tunnel as a do-minimum improvement. The impact of the capacity constraint on the modelled flows is evident, and the response of the model appears to be reasonable. It is noted that Adelaide Road is likely to be approaching capacity as a two lane corridor (with bus lanes) at 26,000 vpd. The overall quantum of traffic growth is generally in line with the forecast growth in population and employment between 2021 and 2031 documented in Appendix 4-C. The key network statistics for 2031 reported at the conclusion of Appendix 4-G also appear to be reasonable.
- 3.51 The extent of population and employment growth assumed in the 2021 high growth scenario, are midway between the 2021 and 2031 medium growth scenarios. It should correspond to an approximate 3-5% increase in flows across the network, however the capacity constraint imposed by the Mount Victoria Tunnel and signals on the Basin Reserve gyratory results in negligible additional growth in the do-minimum model. Traffic growth further afield (Taranaki Street, Tasman Street, Tory Street) is approximately 5% as expected. The 2021 high growth traffic volumes with the project are very similar to the medium growth figures, once again demonstrating the extent to which the Mount Victoria Tunnel constrains flows on the wider network.
- 3.52 The final sensitivity test includes provision for supermarkets on Rugby Street and John Street, and the Adelaide Road growth node and ASB Sports Centre. Whilst the ASB Sports Centre is situated to the east of the Mount Victoria, the other three are likely to increase demand particularly on Adelaide Road, Tasman Road and Tory Street. This is evident from the modelled flows, however the extent of growth will be sensitive to the size of the additional developments which is not disclosed in TR4. Given that the Countdown and ASB Centres are both now built and operational, this sensitivity test is highly relevant. Adelaide Road has been modelled to carry over 30000 vehicles per day which exceeds the theoretical capacity of a two lane urban arterial. The reviewers would like more information as to the capacity of the Adelaide Road corridor and whether an assessment of the operation of the corridor has been considered in more detail.

Assessment of the Alternative Options Omnibus Modelling

- 3.53 Technical Report 19 describes the range of options that have been considered in various studies since 2001 for the Basin Bridge Project. The reporting is relatively high-level and includes very few references to the use of transport modelling to support option assessment. The references to the use of transport modelling within this document are limited to:
- Modelling has been undertaken to assess four packages (combination of options) in the Ngauranga to Airport Strategy Study (2008). No specifics as to the application of transport modelling is provided; and
 - Table B40 in Appendix B compares Options A, F and X implies that SATURN has been used in the assessment of the relative benefits of the three options. It is also apparent from the supporting text in Appendix B that s-Paramics has been used at least for Option F.
- 3.54 Economic evaluation has been undertaken to support the option evaluation in the Feasible Options Report (2009), however there is no mention of any application of transport modelling to support this evaluation. Nor is there any mention of modelling to support the evaluation of War Memorial Tunnel (2010) options, Option X (2011) and Option RR (2012).
- 3.55 Whilst it is established that transport modelling has played a role in the assessment of alternative options, there is insufficient detail provided within TR19 to comment on the appropriateness of the application of modelling to support the conclusions. It is

acknowledged that sufficient detail may be provided in supporting documents referenced in TR19 and that these in turn may have been subjected to an independent peer review process. These supporting documents have not been consulted as the scope of this review is limited to the documentation supporting the Basin Bridge application to the EPA.

Assessment of Pirie / Kent / Cambridge / Vivian Intersection Memorandum

- 3.56 Appendix 4-I reports an assessment of the capacity and some proposed layouts of the Pirie / Kent / Cambridge / Vivian intersection both with and without the Basin Bridge project. Sidra Intersection has been utilised to undertake a detailed assessment of the intersection.
- 3.57 Calibrated 2012 performance results are provided in Table 3 of Appendix 4-I. There are significant discrepancies in peak hour volumes between the surveyed turning movement counts reported in Appendix 4-B (Appendix A) when compared to the demand flows in Table 3 on page 5 of Appendix 4-I. It is acknowledged that the former is 2009 and the latter is 2012 and may include some provision for a Sidra peak flow factor which artificially inflates reported volumes.
- 3.58 The 2012 AM peak hour demand flow is 3,664 vehicles compared to 2009 turning movement total of 3,137 vehicles. The 2012 PM peak hour demand flow is 4421 vehicles compared to a 2009 turning movement total of 3,206 vehicles. Further explanation is requested to understand why these counts are so different, especially regarding the Vivian Street approach in morning and evening peaks, and Cambridge Terrace in the evening peak. What are the implications for the Sidra and/or s-Paramics published results?
- 3.59 The percentage growth factors applied to forecast demand at 2021 have been taken from the SATURN model and are generally consistent with those published in TR4. These factors have been applied correctly and the 2012 and 2021 intersection performance reported appear to be reasonable.
- 3.60 The impact of the Basin Bridge project has been considered with respect to the quantity of Mount Victoria south traffic redirected via Pirie Street. The quantity of traffic has been determined based on an origin-destination survey of Hania and Ellis Street traffic. This is an appropriate method for determining the extent of re-routing, however without having access to the underlying survey data it is not possible to confirm this has been calculated correctly. The morning and interpeak figures appear to be higher than the 2009 surveyed turning movement counts for traffic exiting Hania and Ellice Streets as reported in Appendix 4-B (Appendix A).
- 3.61 The performance of the intersection continues to deteriorate with the inclusion of re-routed traffic. The increase in demand flow totals on the Pirie Street approach in Appendix 4-I Table 7 exceed the increase in volume specified in Table 6, implying the demand flow includes provision for a peak flow factor of approx. 93% in the AM peak and 91% in the PM peak analysis. Confirmation of the application peak flow factors is requested and whether these have changed between base and future year modelling (for example due to the effects of peak spreading).
- 3.62 With the introduction of the Basin Bridge project, SATURN model traffic volumes on the Vivian Street approach reported in Figure 4-41 and 4-65 on TR4 increase from 1500 to 1800 vehicles per hour in the morning peak, and 1500 to 1900 vehicles per hour in the evening peak. A corresponding increase in flow has not been included in the Sidra analysis in Appendix 4-I, however it is likely that the increase in flow is induced as a result of the addition of a third right turn lane as modelled in option 2. It is proposed that a sensitivity test be undertaken to consider the impact of induced growth on the Vivian Street approach. This is of particular importance as the future option 2 intersection is modelled with degree of saturation of over 0.9 in both periods, indicating that it is approaching capacity.

3.63 The conclusions are generally robust and option 2 mitigates the impact of the Basin Bridge in so far as accommodating re-directed traffic, however concerns raised here about the reconciliation of surveyed traffic volumes and the impact of induced traffic at this intersection need to be addressed.

Paramics Network Coding Review

Introduction

3.64 The s-Paramics modelling files have been supplied to allow a review of the coding of the 2021 do minimum and proposed project networks for the morning peak, interpeak and evening peak periods.

3.65 The intention of this review is to ensure that there are no errors in network coding or inappropriate parameter settings which may impact on the accuracy or reliability of the transport modelling outputs. The review of network coding does not extend to include a check of the operation of the traffic signals which use Fuse software.

3.66 The do-minimum network coding has been checked against the network improvements specified in section 3.3.3 of Technical Report 4. The Local Road and NZTA Improvements are described therein with no accompanying road layout diagrams. The Buckle Street Underpass and the Inner City Bypass (ICB) improvements are the only NZTA works specified which are situated within the modelled study area.

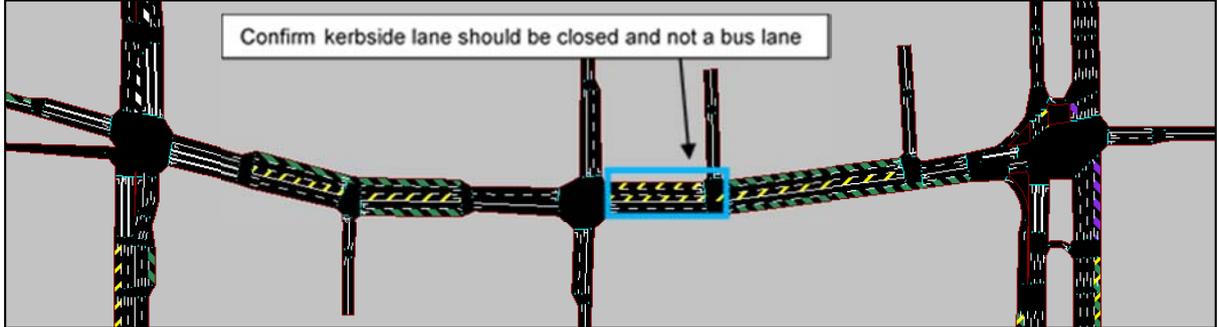
3.67 The Basin Bridge project network coding has been checked against the Basin Bridge proposed road layout plans which accompany the application and are available online on the NZTA website (<http://www.nzta.govt.nz/projects/basin-bridge-application/docs/plan-set-road-layout-plans.pdf>).

Courtenay Place Bus Lanes

3.68 The bus lanes should be included in both do-minimum and proposed networks, and are intended to operate 24 hours a day on Courtenay Place between Manners Mall and Cambridge Terrace.

3.69 All three period models are consistent in terms of layout and include the correct application of restrictions to limit the lanes for bus use only. The intended layout cannot be confirmed without plans. The kerbside lane in the eastbound direction between Tory and Allen Streets is closed to all vehicles including buses. This is consistent between the do minimum and proposed networks and is likely to have negligible impact on flows in the direct vicinity of the Basin Bridge project.

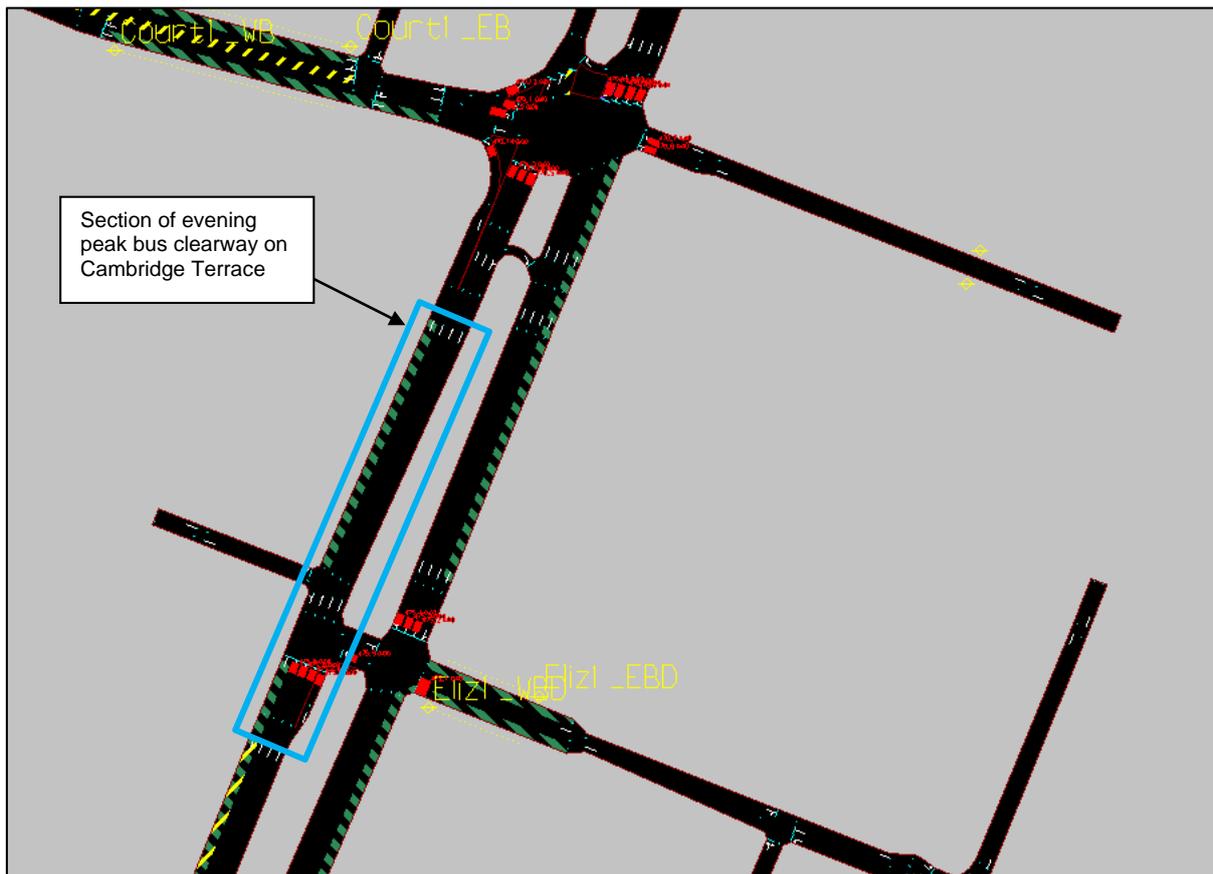
Figure 3.2 Modelled Bus Lane Layout on Courtenay Place



Kent and Cambridge Terrace Clearways

- 3.70 The do-minimum and proposed networks should include northbound clearways in the morning peak and southbound clearways in the evening peak for use by buses only.
- 3.71 In the morning peak the northbound kerbside lane is coded to allow only buses with all vehicles allowed on the approaches to some intersections. Southbound the clearway is closed to all vehicles apart from the approach to the Basin gyratory and Pirie Street in the vicinity of the bus stops in those locations.
- 3.72 In the evening peak the southbound kerbside lane is coded to allow only buses with all vehicles allowed on the approaches to some intersections. Northbound the clearway is closed to all vehicles apart from the links that allow access to the bus stops.
- 3.73 In the northbound direction in the evening peak the approach to Courtenay Place is coded with a bus-only clearway however without plans it is difficult to ascertain if this section is coded correctly considering this section is closed to all vehicles during the interpeak. This is consistent between the do minimum and proposed networks and is likely to have negligible impact on flows in the direct vicinity of the Basin Bridge project.

Figure 3.3 Evening Peak Bus Lane Issue on Cambridge Terrace



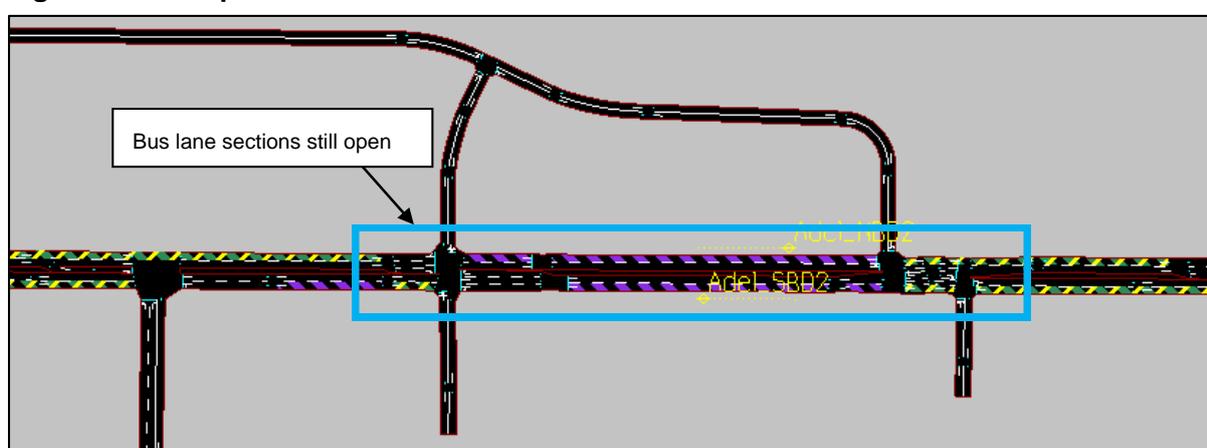
Adelaide Road Bus Lanes

- 3.74 The do-minimum and proposed road networks should include clearways in both directions for the morning peak and evening peak for use by buses however the sections of road that require clearways is not indicated in TR4.
- 3.75 The morning and evening peak models have kerbside lanes on the entire length of Adelaide Road that only permit buses. There are some approaches to intersections

where the kerbside lane also permits general traffic which is a reasonable assumption. The morning and evening peak models are considered to be correctly coded.

- 3.76 In the interpeak networks, the bus lanes are operating between King Street and Drummond Street. There is also a small section southbound south of Drummond Street with the upstream link closed to all traffic. This allows buses to bypass any queues at the signalised pedestrian crossing north of Drummond Street. If vehicles were parked in the clearway during the interpeak period, buses would be unable to bypass these queues.
- 3.77 Ideally, the links in the network should be split such that the buses can only enter and leave the clearway at the bus stops on these links. Further to this the short section of clearway south of Drummond Street should also be closed to all traffic. This is consistent between the do minimum and proposed networks and is likely to have negligible impact on flows in the direct vicinity of the Basin Bridge project.

Figure 3.4 Interpeak Bus Lane Issue on Adelaide Road



Tory/Tasman Street and Cuba Street 30km/h Speed Zones

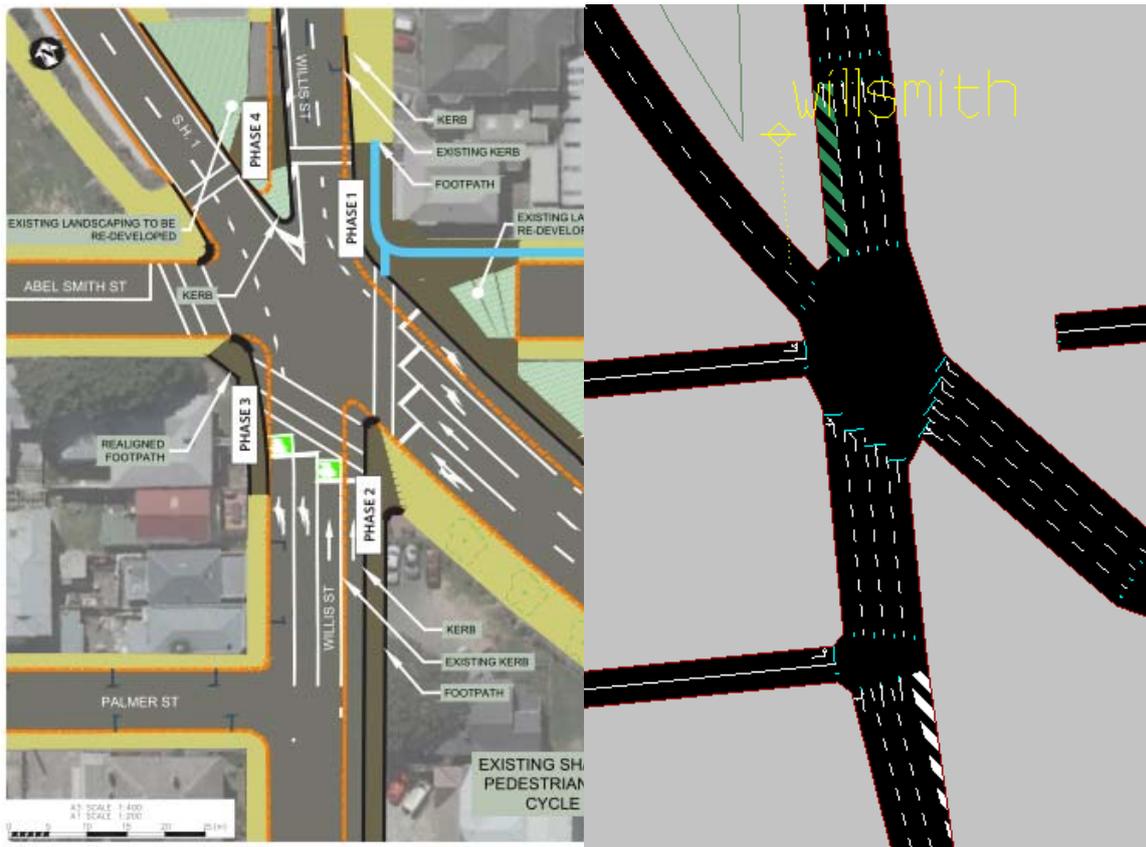
- 3.78 The do-minimum and proposed networks should include 30km/h speed environment on Tory/Tasman Street between Rugby Street and Courtenay Place and also on Cuba Street between Webb Street and Ghuznee Street. The models are correctly coded to include this.

Buckle Street Underpass and ICB Improvements (NZTA Projects)

- 3.79 The Buckle Street Underpass road layout is available on the NZTA website <http://www.nzta.govt.nz/projects/buckle-st-underpass/index.html> and has been used to check the do-minimum coding within the model. The Inner City Bypass improvements are also under construction with completion dates for intersection improvements in 2014. The improvements that have been coded into the model are based as per the moderate intervention option, however there are some key differences between the latest proposed improvements under construction (as specified in <http://www.nzta.govt.nz/projects/buckle-st-underpass/publications.html>) and the moderate interventions specific in TR4 and coded into the model.
- 3.80 The Buckle Street Underpass and ICB improvements coded into the model are consistent with the description provided in TR4, however it is noted that the proposed addition of a third eastbound lane on Vivian Street between Victoria Street and Taranaki Street (included in ICB improvements) is not mentioned in TR4. This is a reporting issue only.

- 3.81 The turning movements at the Arthur Street / Cuba Street intersection have been removed as per the moderate interventions but these appear to still be included in the Buckle Street Underpass road layout drawings on the NZTA website. This is consistent between the do minimum and proposed networks and confirmation is sought over whether this is the appropriate treatment.
- 3.82 There is a minor inconsistency in the number of lanes on Willis Street exiting the Willis / Karo / Abel Smith intersection with four included in the modelled networks and only two proposed as shown in in the ICM improvements. This is consistent between the do minimum and proposed networks and is unlikely to have any noticeable impact on the model operation.

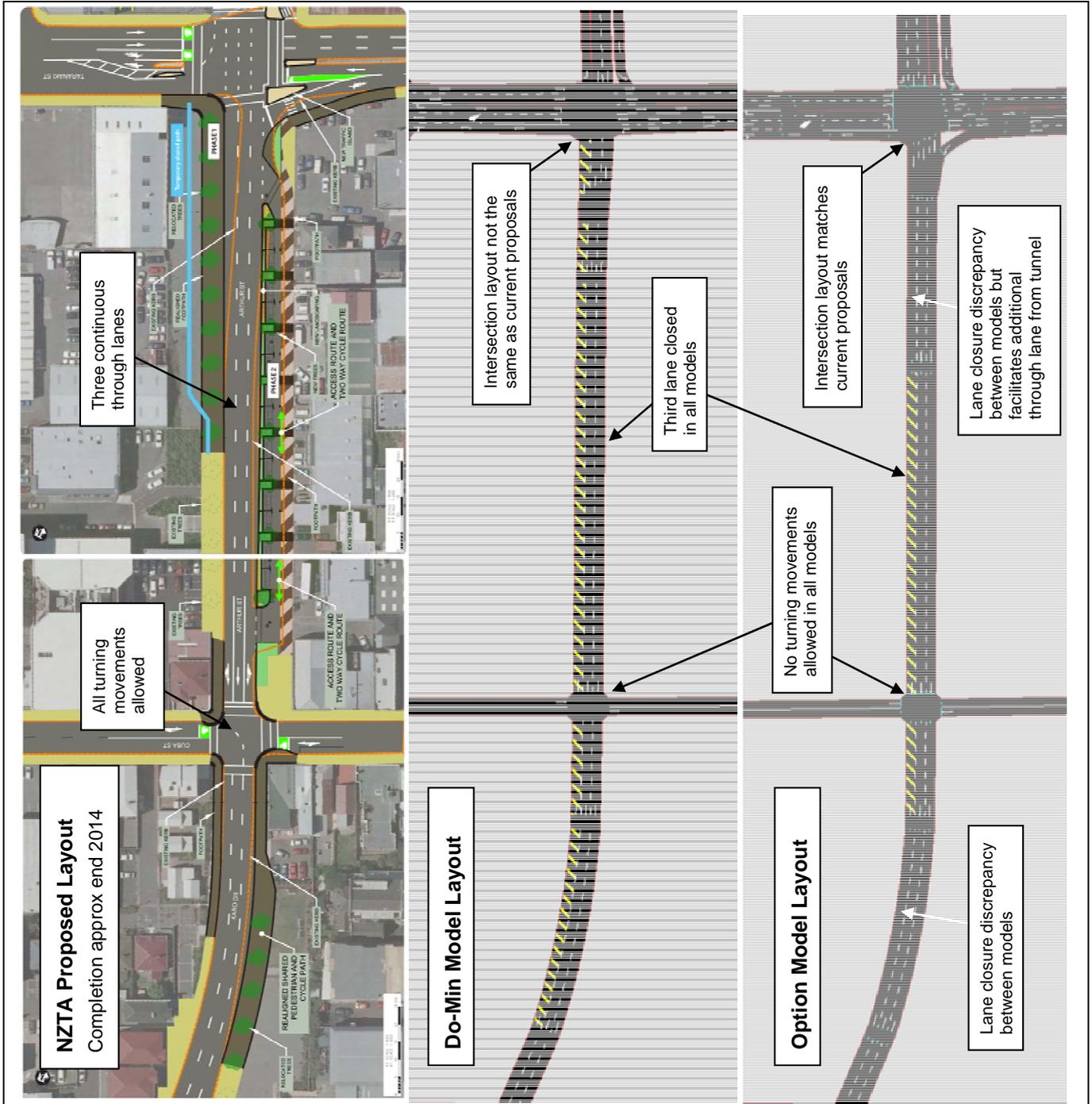
Figure 3.5 SH1 / Willis St / Abel Smith St Intersection Comparison



- 3.83 The proposed improvements on Arthur Street between Taranaki and Cuba Streets as taken from the NZTA website are shown in **Figure 3.6** as well as the modelled layout for this corridor in the do-minimum and proposed networks. The most significant difference is the inclusion of three continuous lanes from Taranaki Street through to Victoria Street on Arthur Street whereas there are only two lanes which are operational in the model (the model does include a third lane but it is closed).
- 3.84 It is unclear from supporting documentation what the correct treatment along Arthur Street should be between Taranaki Street and Victoria Street, however the treatment of the corridor to the east of Taranaki Street and the layout of the Taranaki St intersection are consistent with TR4.
- 3.85 Further to this there are some minor discrepancies between the coding of the do-minimum and proposed networks along this corridor. These are annotated in Figure 3.6 alongside the Buckle Street road layout from the NZTA website. Confirmation is requested to determine whether the do-minimum and proposed networks have been

treated correctly along this corridor, and that the do-minimum network accurately reflects the operation of Arthur Street following the completion of the Buckle Street underpass.

Figure 3.6 Arthur St Intersections Comparison



Vivian Street and Cambridge/Kent Terrace Intersection (Proposed network)

3.86 In the proposed network, there are three lanes on Vivian Street between Tory Street to Cambridge/Kent Terrace and all facilitate a right turn into Kent Terrace. The left and through movement are also available in the northern lane. Pirie Street allows for a left

turn lane and a shared left/right lane. These changes are correctly coded into the Basin Bridge project models.

Changes South of the Basin Reserve (Proposed network)

- 3.87 Dufferin Street will have two general traffic lanes and the bus lane and stop will be closed. The bus stop will move to Rugby St on a new bus lane that will take up one of the lanes that turned into Adelaide Road. These changes are correctly coded into the Basin Bridge project models. The latest plans show that the northbound Adelaide Road traffic will turn into the left hand and centre lane on Rugby Street. The traffic continuing on Rugby Street uses the right hand or inner circulating lane. The phasing is described as continuous and concurrent for vehicle traffic that is only stopped when the shared pedestrian/cycle phase is called. Next-lanes should be adopted at node 169 to ensure that vehicles turn into the correct lanes on Rugby Street to the west of Adelaide Road.
- 3.88 An issue with the proposed layout of the Adelaide/Rugby intersection is the weaving of vehicles from the right hand lane of Rugby Street to exit the gyratory at the left hand lane of Rugby Street heading towards Tasman Street. The model does show that this movement occurs and this movement would be even more difficult when faced with a queue of two lanes of traffic discharging from Adelaide Road following a shared pedestrian/cycle phase. This is an observation which is raised in section 2 of the review.

Changes at Sussex/Buckle Street (Proposed network)

- 3.89 Northbound traffic on Sussex Street should include one lane that allows a left turn movement into the underpass and two lanes turning right to head north and east; the kerbside lane being a bus lane. This has been coded correctly.

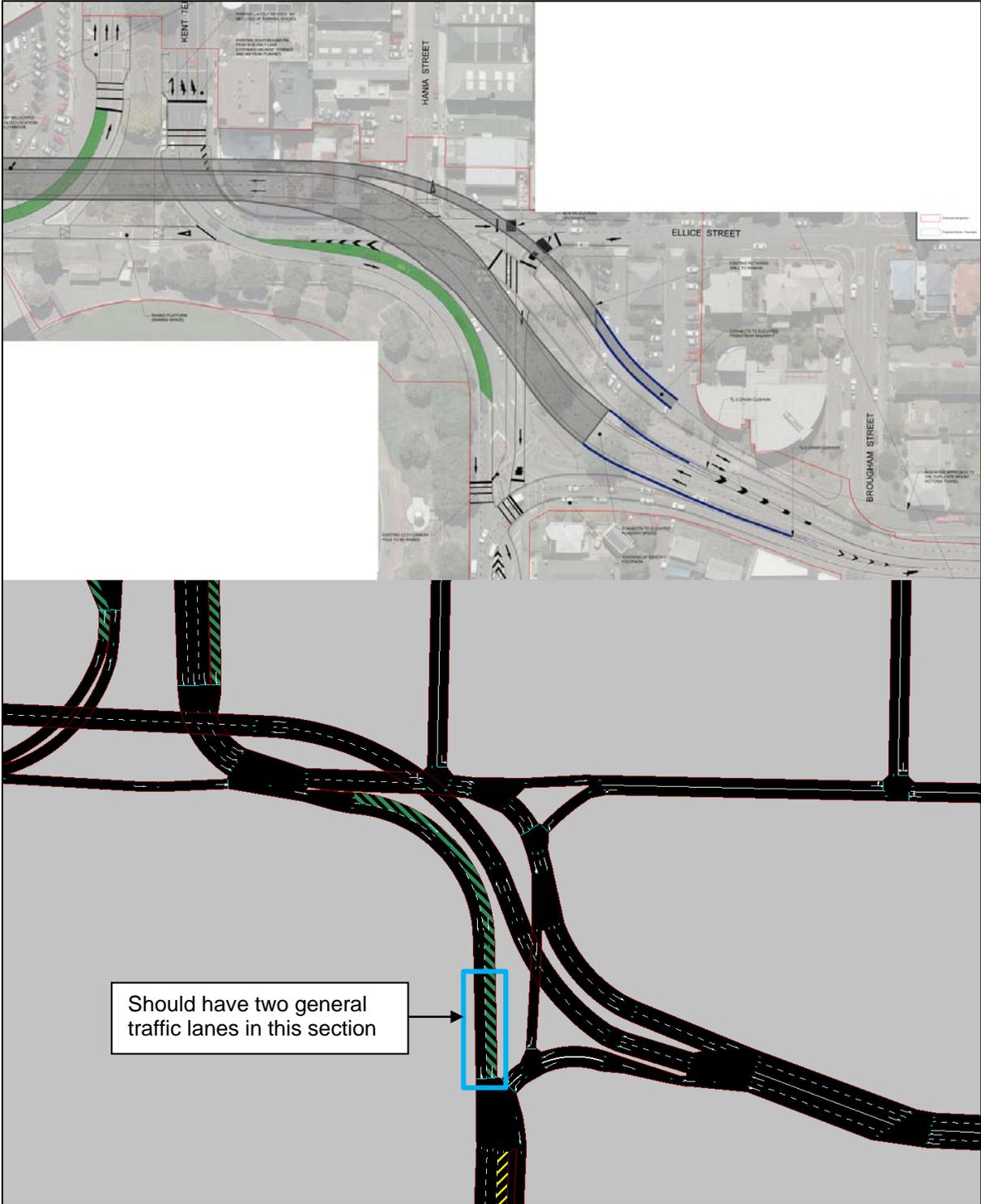
Changes at Cambridge/Kent Terrace/Basin Reserve (Proposed network)

- 3.90 At grade the changes in this location are minimal and the model reflects what is intended. The overbridge has two lanes westbound that connect with the Buckle Street underpass and this is also coded correctly in the model.

Changes at Dufferin/Paterson Street intersection (Proposed network)

- 3.91 The changes in this location associated with the proposed overbridge are shown in **Figure 3.7** as well as the modelled layout. The model reflects the proposed plan well except for the bus lane on Dufferin Street. The bus lane restrictions cease around 30m short of the stop line at the intersection where SH1 traffic enters the Basin Reserve gyratory so that all traffic can use both lanes southbound on Dufferin Street.

Figure 3.7 Eastern Overbridge Connection Comparison



4 SUMMARY OF REVIEW FINDINGS

- 4.1 The key issues raised in this Review of the assessment traffic and transportation effects of the Basin Bridge Project and associated documents is presented as a summary table at the end of this document. Each issue is referenced back to the application documentation, has been rated in terms of the severity of each issue, and a proposed action is specified in each instance.

Item	List of Key Issues	Source Reference	Review Paragraph Reference	Severity	Recommended Action
Consideration of Alternatives					
1	The option evaluation does not identify whether certain evaluation criteria were given more weighting than others, making the logic used to arrive at the preferred options difficult to follow. The reviewers have a number of concerns about the rationale applied to discount Options C and D in particular.	TR 19		2.8 Significant	Recommend that further information be requested from NZTA
2	Option F was discounted on the basis of it being too expensive to construct. Whilst cost is a very important consideration in the evaluation of any project, there has been an apparent inconsistency in approach of comparing options at different stages.	TR19 App.B		2.19 Significant	Recommend that further information be requested from NZTA
3	Apart from the cost estimates provided for Options A, F and X there is no other detailed information provided to demonstrate how the indicative costs were calculated for the remaining options. We recommend a peer review of the construction costs to be carried out if this has not already been done.	TR19		2.21 May be significant	Recommend that consideration be given to undertaking a peer review of the calculated construction costs for each of the options
Transport Assessment Tools					
4	The land use assumptions have included the activities associated with the Rugby Street New World Supermarket, John Street Countdown Supermarket and the ASB Sports Centre as a sensitivity test. As these are either consented or built it is considered that these should have formed part of the future permitted environment.	TR4 Section 3.3.2		2.24 May be significant	Recommend that NZTA provide comment
Assessment Criteria					

Item	List of Key Issues	Source Reference	Review Paragraph Reference	Severity	Recommended Action
5	Two international best practice documents used as part of the assessment have since been superseded, these include Transport Assessment Best Practice, Guide Document May 2006 (Transport for London) and Transport Assessment and Implementation: A guide, August 2005 (Scottish Executive Development Department)	TR4 Section 4.2.2	2.28	Negligible	No action required
6	The Regional Land Transport Programme (RLTP) 2009 - 2012 has since been superseded by the RLTP 2012 - 2015.	TR4 Section 4.3.2	2.30	Negligible	No action required
Baseline					
7	Comparison of the base model traffic flows 2009 and the Do Minimum Traffic Flows 2021 show no peak hour growth through the Mount Victoria Tunnel indicating that the network is operating at capacity in peak hours it is unclear whether this is a function of the side friction imparted by the tunnel or capacity constraints of the Dufferin / Paterson intersection.	TR4 Section 5.7.6	2.31	Unclear	No action required
8	The assumed link capacities are higher than what would be expected, a specific reference to the source of the link capacities and justification to demonstrate their suitability is requested.	TR4 Section 5.7.7	2.32	Minor	Recommend that NZTA provide comment
9	The LoS of intersections have been assessed by queue lengths and journey times. Additional information is requested to justify using queue length as opposed to delay as a measure of LoS, provide some guidance as to what maximum queue lengths are considered to be acceptable and provide additional commentary about where blocking back may be occurring between intersections.	TR4 Section 5.7.7	2.33	Unclear	Recommend that NZTA provide comment

Item	List of Key Issues	Source Reference	Review Paragraph Reference	Severity	Recommended Action
10	There are no details provided in relation to travel patterns for Wellington High Schools or for the University. It would be beneficial to understand what pedestrian demand exists from these activities and how this demand interacts with the proposed Basin Bridge Project.	TR4 Section 5.9.1	2.35	Minor	Recommend that further information be requested from NZTA
11	It is unclear what impact the Mount Cook School pick-up / drop-off activity may have on the Tory / Buckle Street intersection once the area to the south of the school where this currently takes place is no longer available.	TR4 Section 5.9.1	2.36	Unclear	Recommend that further information be requested from NZTA
12	The intersection analysis carried out for the Pirie Street / Kent Terrace / Cambridge Terrace / Vivian Street intersection forecast queue lengths to be as long as 130m on Pirie Street in the AM and PM peak periods which does not correspond with queue lengths of 40 - 50 metres indicated in the Do Minimum morning peak.	TR4 Section 5.9.3, 7.3.4	2.37	Minor	Recommend that NZTA provide comment
Pedestrian and Cyclist Assessment					
13	On road cycle facilities shown on part of Ellice Street and Brougham Street shown in Figure 4-57 do not match the Drawing Sheet No 4C.02. Further clarification is required as to what facilities will or will not be provided at this location.	TR4 Section 7.1.1	2.40	Minor	Recommend that NZTA provide comment
14	There is very limited provision for cyclists / pedestrians to the west of the Basin Reserve, it is considered that suitable provision for cyclists on the western side of the Basin Reserve should be included as part of this project.	TR4 Section 7.1	2.41	Moderate	Recommend that NZTA provide comment

Item	List of Key Issues	Source Reference	Review Paragraph Reference	Severity	Recommended Action
15	It is unclear what existing pedestrian or cyclist demand existing from the Mount Victoria Tunnel to the Buckle / Tory Street intersection. Further information is requested to support the assumed demand of 625 weekday trips and 299 weekend trips for the bridge.	TR4 Section 5.4.3	2.42	May be moderate	Recommend that further information be requested from NZTA
16	Future pedestrian and cyclist demands may need to be reconsidered due to the significant increase shown from the WCC Transport Monitoring Survey to still confirm the predicted 2% per annum growth is still valid and that pedestrian and cyclist facilities have not been under-designed.	TR4 Section 7.1.3	2.44	May be moderate	Recommend that further information be requested from NZTA
17	There is potential for a large speed differential that may exist on the ramp between cyclists travelling downhill and other users.	TR4 Section 7.1.3	2.45	Moderate	Recommend that NZTA provide comment
18	The location of the drop kerbs adjacent to the raised platform zebra crossing is a complex and confusing arrangement that is likely to resulting poor safety outcomes.	TR4 Section 7.1.9	2.46	May be moderate	Recommend that NZTA provide comment
Safety Assessment					
19	TR4 appears to be contradictory in identifying the type of controls that traffic entering and exiting the Link Road will be subject to, clarification is requested in relation to this.	TR4 Section 7.3.6, 7.8.5	2.48	Moderate	Recommend that NZTA provide comment
20	The reviewers consider the movement of traffic from Ellice Street to the link road should be signalised and operate in conjunction with the pedestrian crosswalk.	TR4 Section 7.3.6, 7.8.5	2.49	Moderate	Recommend that NZTA provide comment

Item	List of Key Issues	Source Reference	Review Paragraph Reference	Severity	Recommended Action
21	The reviewers consider that the Paterson Street end of the Link Road should be signalised and incorporated into the operation of the intersection, alternatively the Link Road should intersect Paterson Street further from the Dufferin Street intersection.	TR4 Section 7.3.6, 7.8.5	2.50	Moderate	Recommend that NZTA provide comment
Accessibility Assessment					
22	The layout of the school bus pick-up / drop-off area to the south of Rugby Street is significantly less than the current bus parking provision. Further evidence requested to show the number of buses can be accommodated within this area.	TR4 Section 7.8.2	2.51	Minor	Recommend that NZTA provide comment
22	Observation of the s-Paramics model shows that a moderate number of vehicles travelling from Ellice Street will use the Link Road. The report states that the Link Road is not expected to be a preferred route for Mount Victoria residents however further information is requested to support this statement and the physical measures implemented to achieve this. A comparison against alternative routes would be helpful.	TR4 Section 7.8.5	2.52	Minor	Recommend that NZTA provide comment
23	The layout of the Link Road through to the school drop-off pick-up area does not enable school buses to easily manoeuvre across.	TR4 Section 7.3.6, 7.8.5	2.54	Minor	Recommend that NZTA provide comment
24	A potentially dangerous weaving situation is identified where vehicles manoeuvre from the right hand lane of Rugby Street to exit at the left hand lane of Rugby Street heading toward the Tasman / Rugby Street intersection. This may be exacerbated by the traffic from the Adelaide Road / Rugby Street intersection being discharged at the same time following the shared pedestrian / cycle phase.	TR4 Section 7.3.6	2.56	Significant	Recommend that NZTA provide comment

Item	List of Key Issues	Source Reference	Review Paragraph Reference	Severity	Recommended Action
Construction Assessment					
25	Westbound traffic may experience delays of up to 118 seconds of additional travel time during the PM period during Stage 3 of the Project. Whilst this is substantial, it is acknowledged that this does not take into account re-routing which may occur which is likely to reduce delays.	TR4 Section 7.9.1	2.58	Minor	No action required
Assessment against the Wellington Regional Land Transport Strategy 2010 - 2040 (RLTS)					
26	It is acknowledged that the Project will generally contribute to positive outcomes in relation to (4.3), (6.2) and (7.2) which are not specifically addressed in the documentation. While consistency of the project with (3.2) is debateable, reducing private car mode share is not intrinsically related to any of the overall project objectives and so no further action is considered necessary.	TR4 Section 7.11	2.62	Negligible	No action required
Future Proofing and Sensitivity Tests					
27	An update is requested following the completion of the PT Spine testing using WTSM and further details provided relating to the changes in PT and Vehicle demands through the project area.	TR4 Section 9.1	2.64	Unclear	Recommend that NZTA provide comment
Use of models					
28	Discuss the limitations and/or risks (if any) introduced by assuming an interim update to the WTSM rather than progressing with a fully updated model.	TR4 section 3.2.1	3.6	Unclear	Recommend that NZTA provide comment
Role of models and modal split					

Item	List of Key Issues	Source Reference	Review Paragraph Reference	Severity	Recommended Action
29	No information provided as to the nature of extent of public transport model improvements undertaken, and any limitations arising from using a less detailed model that may affect the assessment of this project.	TR4 section 3.2.1	3.10	Minor	Recommend that NZTA provide comment
30	Modelled changes in passenger transport numbers with the inclusion of the Basin Bridge project have not been reported. Is any net change anticipated?	TR4 section 7.2	3.11	Minor	Recommend that NZTA provide comment
Inputs and assumptions					
31	There are key differences between the ICB improvements under construction and the moderate interventions reported in TR4. What is the impact of these differences on the merits of the project?	TR4 section 3.3.3	3.26	Unclear	Recommend that NZTA provide comment
32	Express route 32 is not listed in those routes travelling through the Basin Reserve Gyratory.	TR4 Table 4-3	3.30	Negligible	No action required
33	How well do the 2011 modelled passenger flows match surveys? More details regarding how passenger transport has been modelled would be useful to understand how reliably it is modelled.	TR4 section 5.5.3	3.31	Unclear	Recommend that NZTA provide comment
34	Evidence is requested that the version of WTSM and SATURN used in this assessment have passed peer review and any post-review issues have been addressed satisfactorily. The John Bolland peer review in Appendix 4-C of TR4 appears to address a more recent version of the WTSM - is this correct?	TR4 general	3.32/3.35	Unclear	Recommend that NZTA provide comment

Item	List of Key Issues	Source Reference	Review Paragraph Reference	Severity	Recommended Action
Model Calibration and Validation					
35	The post-2021 passenger transport passenger volumes around the Basin Reserve show flat growth or a decline. Is there a logical explanation for this result?	TR4 section 5.5.3	3.36	Minor	Recommend that NZTA provide comment
36	Outline the process by which the WTSM outputs are transformed to SATURN inputs, or provide evidence that this process has successfully passed a previous peer review.	TR4 section 3.2	3.37	Unclear	Recommend that NZTA provide comment
37	How extensive was the origin-destination survey specified in Appendix 4-I and has it been used to validate movements around the Basin Reserve, particularly the SH1 westbound through movement?	TR4 Appendix 4-I page 6	3.41	Unclear	Recommend that NZTA provide comment
38	The route 1 (SH1) westbound journey time does not appear to validate well in the vicinity of the Basin Reserve. Can the validation for route 1 be split into three portions to isolate the section between Mt Victoria tunnel and Buckle Street? Does this section of SH1 meet DMRB criteria in all three periods and if not, what is the resultant impact on the assessment?	TR4 Appendix 4-B Appendix B	3.44	May be significant	Recommend that further information be requested from NZTA
Sensitivity Testing					
39	Under some sensitivity test scenarios, Adelaide Rd is carrying over 30000 vehicles per day. What is the capacity of Adelaide Rd, and how will the corridor operate at these volumes? Has this been properly assessed and what are the risks to the operation of the local network?	TR4 section 9.3	3.50	May be significant	Recommend that further information be requested from NZTA
Assessment of the Alternative Options Omnibus Modelling					

Item	List of Key Issues	Source Reference	Review Paragraph Reference	Severity	Recommended Action
40	There is insufficient detail to comment on the appropriateness of the application of transportation modelling to support the conclusions. Can more information be provided as to the role of modelling in the assessment of alternative options with particular reference to the economic analysis of options?	TN9 general	3.53	Unclear	Recommend that further information be requested from NZTA
Assessment of Pirie/Kent/Cambridge/Vivian Intersection Memorandum					
41	Turning movements reported in Appendix 4-B Appendix A (2009) and in Table 3 of Appendix 4-I (2012) do not reconcile at this intersection, with 2012 flows more than 30% higher in the PM peak. Explanation is required to justify the differences between the counts. An assessment of the implications for the project particularly for the design and operation of this intersection is requested.	TR4 Appendix 4-B Appendix A; TR4 Appendix 4-I Table 3	3.57	May be significant	Recommend that further information be requested from NZTA
42	A component of the difference highlighted in Issue 41 above is likely to be due to the application of peak flow factors. Detail as to the calibration and application of peak flow factors in the base and future year modelling is requested.	TR4 Appendix 4-I general	3.61	Minor	Recommend that NZTA provide comment
43	The analysis in TR4 indicates that flows along Vivian Street increase (that is are induced) when the Basin Bridge project is included in the model. A sensitivity test of the operation of the option 2 intersection layout is requested to demonstrate that it is can operate satisfactorily with higher flows on the Vivian Street approach.	TR4 Appendix 4-I general	3.62	May be significant	Recommend that further information be requested from NZTA
Paramics network coding					

Item	List of Key Issues	Source Reference	Review Paragraph Reference	Severity	Recommended Action
44	There is no provision for a kerbside bus lane on Courtenay Place in the eastbound direction between Tory and Allen Streets - is this correct?	s-Paramics files	3.69	Minor	Recommend that NZTA provide comment
45	There is provision for a bus lane at the northern end of Cambridge Terrace in the PM peak - is this correct?	s-Paramics files	3.73	Negligible	Recommend that NZTA provide comment
46	Some sections of the Adelaide Rd bus lanes are operating in the interpeak period but are only supposed to be operating in peak periods.	s-Paramics files	3.74-3.77	Minor	Recommend that NZTA provide comment
47	There are additional exit lanes provided on Willis Street exit to SH1/Willis Street/Abel Smith St intersection but these are unlikely to affect the operation of the model.	s-Paramics files	3.82	Negligible	No action required
48	It is not clear whether the do minimum improvements in the vicinity of the Buckle Street underpass are coded accurately to the west of Taranaki Street and these are not consistent with current ICB improvements proposed on the NZTA website. This is raised as issue 4 above and further comment would be appreciated as to whether the do minimum and proposed networks reflect these changes appropriately.	s-Paramics files	3.83-3.85	Unclear	Recommend that NZTA provide comment
49	The bus lane restrictions southbound on Dufferin Street should cease around 30m short of the stop line so that all traffic can use both lanes southbound on Dufferin Street. Comment on the extent to which this may change the model performance is requested.	s-Paramics files	3.91	Minor	Recommend that NZTA provide comment

Abley Transportation Consultants Limited www.abley.com info@abley.com

Christchurch phone +64(0)3 377 4703 fax +64(0)3 377 4702
Level 1 and 2, 30a Carlyle Street
PO Box 25350, Christchurch 8144, New Zealand

Auckland phone +64(0)9 974 9820 fax +64(0)9 974 9824
PO Box 911336, Auckland 1142, New Zealand