IN THE MATTER of the Resource Management Act 1991

AND

IN THE MATTER of an application to **TASMAN DISTRICT COUNCIL** by **BEKON MEDIA LIMITED** under section 88 of the Act for resource consent to authorise the establishment and display of a digital billboard at 332 Queen Street, Richmond

STATEMENT OF EVIDENCE OF ANDREW DAVID CARR

1. INTRODUCTION

1.1 My full name is Andrew ("Andy") David Carr. I am a director of Carriageway Consulting Ltd (**CCL**), a specialist traffic engineering and transport planning consultancy which I founded at the start of 2014.

Qualifications and experience

1.2 In terms of academic qualifications, I hold a:

(a) Bachelors (Honours) degree in Computing Science (1988);

(b) Masters degree in Transport Engineering and Operations (1989); and

(c) Masters degree in Business Administration (1998),

all from the University of Newcastle upon Tyne in the United Kingdom.

1.3 I am a Chartered Professional Engineer and an International Professional Engineer (New Zealand section of the register).

1.4 I have more than 35 years' experience in traffic engineering, during which I have been responsible for investigating and evaluating the traffic and transportation impacts of a wide range of land use developments, both in New Zealand and the United Kingdom. I have also been a hearing commissioner and have acted in that role for Greater Wellington Regional

Council, Ashburton District Council, Waimakariri District Council and Christchurch City Council.

1.5 Prior to establishing CCL, I was employed by traffic engineering consultancies in which I had senior roles in developing the business, undertaking technical work and supervising project teams primarily within the South Island. I worked with Mr Harries at Traffic Design Group between 2004 and 2012, although we were based in different offices.

1.6 I am a Chartered Member of Engineering New Zealand (formerly the Institution of Professional Engineers New Zealand), and an Associate Member of the New Zealand Planning Institute.

1.7 I also served on the National Committee of the Resource Management Law Association between 2013-14 and 2015-17, and I am a past Chair of the Canterbury Brancah of the organisation.

1.8 I have been involved in assessing the potential road safety effects of around 70 proposed digital billboard installations throughout New Zealand. My role has been as both a peer reviewer for the relevant consent authority and also providing reports for applicants. As a part of this work, I have reviewed in detail over 80 published research papers regarding digital billboards and I have also commissioned my own research in New Zealand, which I understand to be the first of its kind in the country.

Involvement in the Bekon Media project

1.9 I was engaged by the Applicant, Bekon Media Limited (**Bekon** or **the Applicant**) to provide an assessment of the effects on road safety and roading efficiency which may arise as a result of its proposal to establish and operate a digital billboard at 322 Queen Street, Richmond (**the site**). As part of this process, I was responsible for producing a report which assessed the relevant transportation matters relating to the site and the billboard, dated 21 May 2024 (entitled 'Assessment of Transportation Matters', **ATM**). As part of this, I visited the site in April 2023.

1.10 I adopt and rely on that report for the purpose of my evidence, other than as modified below to take account of revisions made to the proposal during the application process.

1.11 The assessments and reports I have reviewed for the purpose of undertaking my analysis and producing my evidence include:

(a) *Application for resource consent to the Tasman District Council - land use consent to establish a single-sided, 24.5m2 digital billboard for off-site advertising at 332 Queen Street, Richmond*, dated 21 May 2024, prepared by Town Planning Group (NZ) Ltd, as lodged with the Application;

(b) *Consent Application RM230535, 332 Queen Street, Richmond - Review of Traffic Effects* (two reports, dated 7 December 2023 and 19 September 2024), prepared on behalf of Tasman District Council by Ari Fon of Affirm NZ Ltd;

(c) *Notification / non-notification decision report,* dated 19 December 2023, prepared for Tasman District Council by Phil Doole;

(d) Various *Submission on Resource Consent Application* forms as received by Tasman District Council from lay submitters;

(e) The NZTA submission, dated 14 October 2022, prepared by Jeremy Talbot for NZTA;

(f) The Tasman District Council Section 42A report prepared by Victoria Woodbridge for the purposes of the consent hearing ("s42A report");

(g) The Town Planning Group letter of 7 October 2024 from Ms Collie advising Tasman District Council of proposed amendments to the application;

Purpose and scope of evidence

1.12 The purpose of my evidence is to address road safety issues arising in the context of this application, particularly in light of the issues raised by New Zealand Transport Agency / Waka Kotahi's (**NZTA**) submission opposing the proposed billboard.

1.13 In doing so, my evidence addresses the following:

(a) A brief summary of the key elements of the proposal, including the location of the billboard, the revisions made since the application was notified and its visibility from various locations (Section 3);

(b) The existing traffic environment (Section 4);

(c) An assessment of the anticipated effects of the proposed billboard, drawing on available research (Section 5);

(d) An assessment against the New Zealand Transport Agency Traffic Control Devices Manual Part 3 ('Advertising Signs') (**TCDM3**) Guideline (Section 6);

(e) The proximity of the traffic signals to the proposed billboard (Section 7);

(f) Relevant road safety considerations (Section 8);

(g) The proposed conditions of consent (Section 9);

(h) My comments on the section 42A report (Section 10);

(i) My comments on submissions made to the application (Section 11); and

(j) My comments on the Waka Kotahi submission (Section 12).

1.14 A summary of my evidence is contained in Section 2.

1.15 At the outset, I note that the proposed billboard is a new feature within the environment, and does not replace an existing billboard. As such, it is appropriate in assessing potential road safety effects to have regard to visual mock-ups and drawings, rather than having reference to the prevailing conditions at the application site.

Expert Witness Code of Conduct

1.16 I have read the Code of Conduct for Expert Witnesses, contained in the Environment Court Practice Note (2023) and I agree to comply with it. I can confirm that the issues addressed in this statement are within my area of expertise and that in preparing my evidence I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

2. SUMMARY OF EVIDENCE

2.1 The proposal is slightly different to that which was notified, with changes made to reorientate the billboard so that it faces away from Lower Queen Street and more towards Gladstone Road, an increased to the dwell time (to 30 seconds from 8 seconds) and the construction of a parapet around the billboard. From a transportation perspective, I do not consider that the

parapet will materially change the road safety effects of the proposed billboard and I have not considered it further.

2.2 The approach that I have taken has been to carefully review the transportation environment around the site, the particular characteristics of digital billboards and the way that they are operated in New Zealand, and then to assess whether the proposed digital billboard is likely to have adverse road safety effects in this location.

2.3 Submitters, NZTA and the Council have raised the matter of the current road safety record in this location, with the Council's consultant traffic engineer Mr Fon stating that the intersection is within the worst 30% of intersections throughout the country, with the highest number of reported injury crashes of any urban intersection in Nelson and Tasman between 2019 and 2023. However, this assertion is made with reference to all crashes reported at the intersection, and not to the locations where road users would have been able to see the billboard (if it had been in place).

2.4 In my view, it is self-evident that if a billboard cannot be seen, it cannot affect road user behaviour and cannot not have any effect on those road users. I therefore consider that the crash reporting used by Mr Fon includes a greater number of crashes than is relevant in this case. In particular, within my own assessment, I have identified that 50% of the crashes referred to by Mr Fon are not relevant to this application.

2.5 I have carefully reviewed the remaining crashes and considered whether the proposed billboard could have affected driver behaviour. Taking into account the particular circumstances of each crash based on the comments of the reporting police officer (rather than just the number of crashes), I conclude that the nature and frequency of reported crashes would be unlikely to be influenced by the presence of the proposed billboard.

2.6 As part of evaluating safety-related, I have also considered the available research into digital billboards, based both on published research and work that I have carried out myself. Published research needs in my view to be interpreted and treated cautiously, because there are a number of ways in which digital billboards can potentially be operated (such as having very short dwell times, being very bright or changing from one image to another instantaneously) that are reasonably conclusively shown to attract driver attention and elevate crash risk. However, many published papers do not set out how the studied billboard(s) operated, and therefore the outcomes of those papers are not directly applicable to either a New Zealand context or to the current application.

2.7 That said, even with this caveat, the results of published research do not demonstrate a clear and unequivocal causal link between the presence of digital billboards and adverse road safety outcomes.

2.8 My own research into the New Zealand context (which to my knowledge remains the only research of its kind in the country) does not show that crash rates increase once a digital billboard is installed. Rather, there is no statistical difference observed. In my opinion, one plausible explanation for this outcome relates to the way that digital billboards are controlled in respect of their operation in New Zealand. That is, the factors that overseas studies show can potentially have an adverse effect on road safety are managed in New Zealand through conditions of consent to eliminate (or substantially mitigate) those characteristics.

2.9 Digital billboards are no longer a novel or unusual feature in the roading environment, and drivers are well-used to their presence. I am aware that there are nearly 500 large-format digital signs operating in the country (as well as many smaller screen in bus shelters and on-premise screens) and I conservatively estimate that since their introduction, there have been at least 5.5 billion views of such billboards by drivers. Despite this, a review of the Waka Kotahi CAS database shows there has been no reported crash in which distraction from a consented digital billboard has been cited as a contributing factor.

2.10 In passing, I refer to 'consented' digital billboards above because this is the area where I have carried out specific research. There are many locations in New Zealand where there is on-premise digital advertising that is able to be seen by drivers and that is not subject to the same controls as off-site advertising and, in my experience, these screens can include animation, instructions to drivers, flashing and representations of traffic signs. I am unaware of any adverse road safety effects arising from these (and they do not seem to raise concerns for NZTA or Councils), but I have not formally undertaken a more formal research study into these.

2.11 In respect of dwell time, after carefully considering the submissions made and the s 42A report, coupled with discussions with NZTA, I recommend that each image should be displayed for a minimum of 30 seconds, rather than the 8 seconds in the notified application. Increasing the dwell time in this manner means that fewer drivers will see a change of image. While I highlight that there is no evidence in my view that changing an image creates any additional road safety risk, the greater dwell time should more than adequately address any perceived concerns in this regard.

2.12 I consider that the proposed conditions of consent are appropriate to control those aspects of digital billboard operation that can lead to adverse effects.

2.13 Consequently, I am able to support the proposed billboard from a road safety and roading efficiency perspective.

3. THE PROPOSAL

Overview

3.1 The proposal is to install a single-sided digital billboard at the site at 322 Queen Street (**the proposed billboard)**.

3.2 The billboard is proposed to be located on the roof of an existing building on the eastern quadrant of a signalised intersection, where Gladstone Road, Queen Street, Lower Queen Street and Richmond Deviation meet.

3.3 The application as lodged showed that the proposed billboard was intended to be orientated towards the west, and images would therefore be visible to drivers travelling southeast on Lower Queen Street, and northeast on Gladstone Road (which forms part of State Highway 6).

3.4 However, following discussions with NZTA, the proposed billboard has been reorientated to face Gladstone Road and to turn so that it is no longer visible to vehicles travelling on most of Lower Queen Street. The billboard reorientation is shown below.

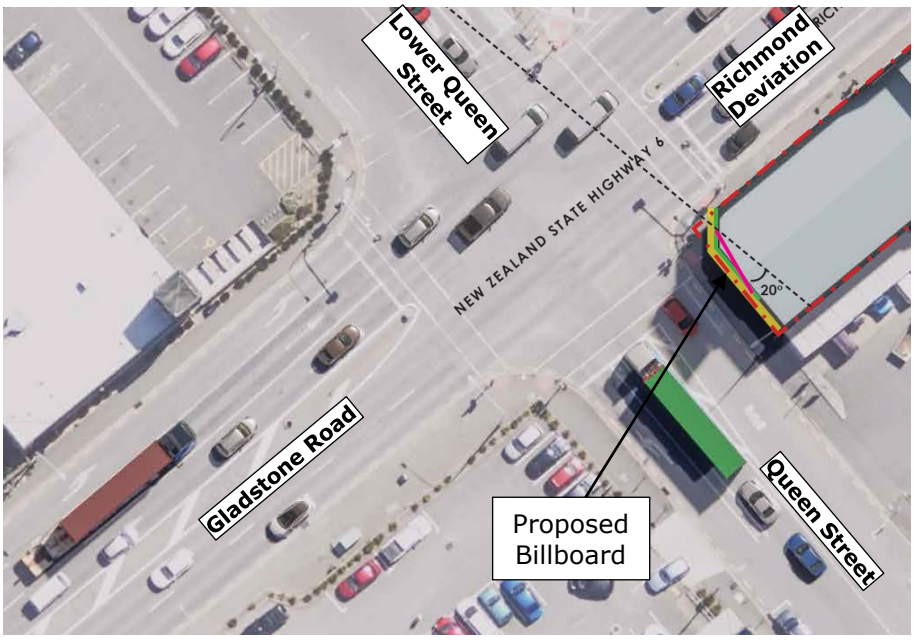

Figure 1: Proposed Reorientation of the Billboard (Extract from DCM Urban Drawing)

3.5 In addition, a parapet is to be added to the building within which the billboard will be mounted, and the dwell time is increased to 30 seconds from the 8 seconds previously proposed.

3.6 As per the original application, the proposed billboard will be 7m wide and 3.5m high, with the bottom of the billboard being 5.3m above ground level, and will be in 'landscape' orientation.

3.7 Consent conditions have been proposed, requiring the billboard to operate with the following key characteristics:

(a) A minimum dwell time of 30 seconds;

(b) Images changes that will transition by way of 0.5 second dissolve; and

(c) Screen luminance that will be controlled to maximum luminance levels of 5,000 cd/m² between sunrise and sunset (daylight hours) and 125 cd/m² between sunset and sunrise (night hours), and automatically managed so screen luminance is responsive to ambient light conditions.

Billboard location and viewing angle

3.8 Initially, I have considered whether any (transport-related) assessment is required of the billboard from Richmond Deviation (northeast), Queen Street, or Lower Queen Street.

3.9 TCDM3 sets out a 'cone of vision for drivers', being the area in which drivers look when travelling at certain speeds. I am also aware that the technology used in digital billboards means that, at very shallow angles, the display appears black. As the angle increases, a digital billboard initially appears as a lit area but without the image being legible or comprehensible due to the shallow angle of view.

3.10 Despite investigations, I have been unable to source any formal research that has been carried out into the angle of view at which a driver starts to perceive an image. It is instructive, however, that the same technology is used in digital billboards as is used in flat-screen televisions, and there are numerous manufacturer sources that cite a viewing angle of 140 degrees for

televisions - that is, that the image can be viewed between a perpendicular angle to the screen and 70 degrees.

3.11 This angle corresponds to my own observations of viewing digital billboards. There is a large digital billboard at Christchurch airport (facing the Memorial Avenue / Orchard Road roundabout) with footpaths on the approaches. This means it is very straightforward to stop to view the images displayed and to then use aerial photographs to assess the angle of view.

3.12 In my experience, the angle at which the images transition between a patch of lit area into a more distinguishable image aligns with a 20-degree viewing angle. Figure 3 below demonstrates a 15 degree, 20 degree and 25 degree viewing angle of the same image.

Figure 2: Image Viewed at Perpendicular

15 degree angle *20 degree angle* *25 degree angle*

Figure 3: Images Viewed at Different Angles

3.13 For clarity, I have resized the images very slightly so that the height of the nearest part of the billboard is the same in each case. In my view, the images show that, at 15 degrees, the text cannot be read (although the image of the pizza might be discernible) but by 20 degrees, the messaging is far clearer and at 25 degrees, it is easily read.

3.14 On this basis, in my opinion it is reasonable to allow for a 20-degree viewing angle as the minimum angle required for approaching road users to have any interest in looking at a digital billboard and this is what has been used in this instance. The 20-degree angle has been shown on the drawing below, and I refer to this 20-degree angle as the 'viewing angle' throughout the remainder of this statement of evidence.

Figure 4: 20-Degree Angle of View

3.15 Figure 4 shows that the proposed billboard lies outside the viewing angle for drivers on from Richmond Deviation. It would briefly be within the viewing angle for drivers on Queen Street, but at that point, it would be well above the height of the driver and be moving outside their cone of vision.

3.16 On Lower Queen Street, the reorientated digital billboard lies outside the viewing angle for drivers travelling in the left-turn slip lane. There is a slight potential for drivers that are at the stop-lines of the approach in the 'straight ahead' lane to be able to read the proposed billboard, but the viewing angle means that this would only be practical for drivers at the front of the queue, as at distances further back, the proposed billboard is outside the viewing angle.

3.17 The potential exists for drivers to be able to read an image when travelling in the right-turn traffic lane. The proposed billboard is within the viewing angle at a distance of 21m (and closer) to the stop-line. As I addressed in the ATM, drivers require a certain minimum distance in which to perceive traffic signals, decide to stop, and then stop. This is referred to as the Approach Sight Distance (**ASD**).

3.18 In this case, 21m aligns with an ASD for an operating speed of 25km/h. In other words, if drivers are approaching the traffic signals at a speed of more than 25km/h, they will have already passed their final decision point about whether to stop or not by the time that they move within the viewing angle of the proposed billboard. If travelling at less than 25km/h, they will move into the viewing angle of the proposed billboard at 21m from the stop-line, but this slow speed suggests that drivers are already in the process of stopping at a red traffic signal, or are travelling in congested conditions in which their cues to stop are also provided via the actions of drivers around (and particularly ahead of) them. As such, I do not consider that these views from Lower Queen Street to be material.

3.19 It is clear that the proposed billboard will be visible to drivers on Gladstone Road. On this basis, my assessment is focussed on Gladstone Road, but I refer to views from Lower Queen Street as appropriate. I have not considered Richmond Deviation or Queen Street any further.

4. THE TRAFFIC ENVIRONMENT

Road geometries

4.1 Gladstone Road forms part of State Highway 6. On the approach to the location of the proposed billboard, the highway cross-section is influenced by the presence of intersections although, typically, it provides two lanes in each direction, separated by a flush median. Kerbside parking is not permitted on either side of the highway. The highway has a flat and straight alignment in this location and is subject to a 50km/h speed limit.

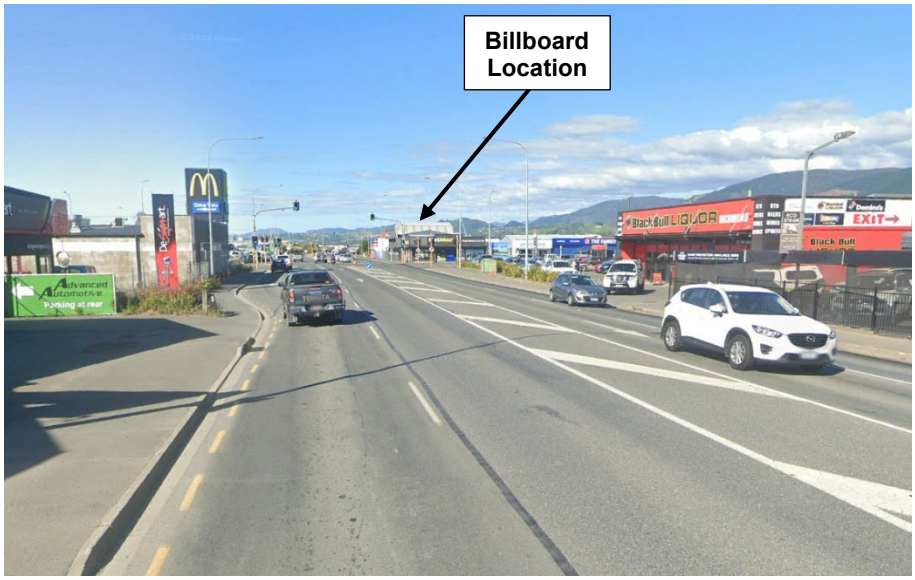

Figure 5: Gladstone Road Looking East

4.2 Approximately 70m west of the location of the proposed billboard, the kerbline of Gladstone Road flares to develop an auxiliary lane for vehicles that are turning left at the Gladstone Road / Lower Queen Street intersection. The right turn movement from Gladstone Road into Queen Street is not permitted, with four RG-7 'no right turn' signs provided. As a result, there are three traffic lanes on the immediate approach to the intersection.

Figure 6: Gladstone Road Approach to Intersection with Lower Queen Street

4.3 The Gladstone Road / Lower Queen Street intersection is signalised, with five signal heads facing eastbound traffic on Gladstone Road (primary, overhead primary, secondary, overhead secondary and tertiary). RG-7 'no right turn' signs are affixed to the three of the signal poles at the intersection. There is

a raised island for 20m on the approach, and the fourth RG-7 sign is free-standing and positioned at the end of this island. There are pedestrian crossing phases on each approach (although the carriageway markings for the crossing are heavily worn in places).

4.4 There are footpaths on each side of the highway, and there are multiple driveways on either side which serve the well-established commercial activities that front the highway. There are no cycling facilities on the highway.

4.5 Lower Queen Street is subject to a 50km/h speed limit and has a flat and straight alignment. It typically provides one traffic lane in each direction, but south of Stratford Street (110m northwest of Gladstone Road) the road widens to develop two southbound lanes at the intersection with Gladstone Road (straight ahead and right turn), plus also a left turn 'slip lane' which is not signalised.

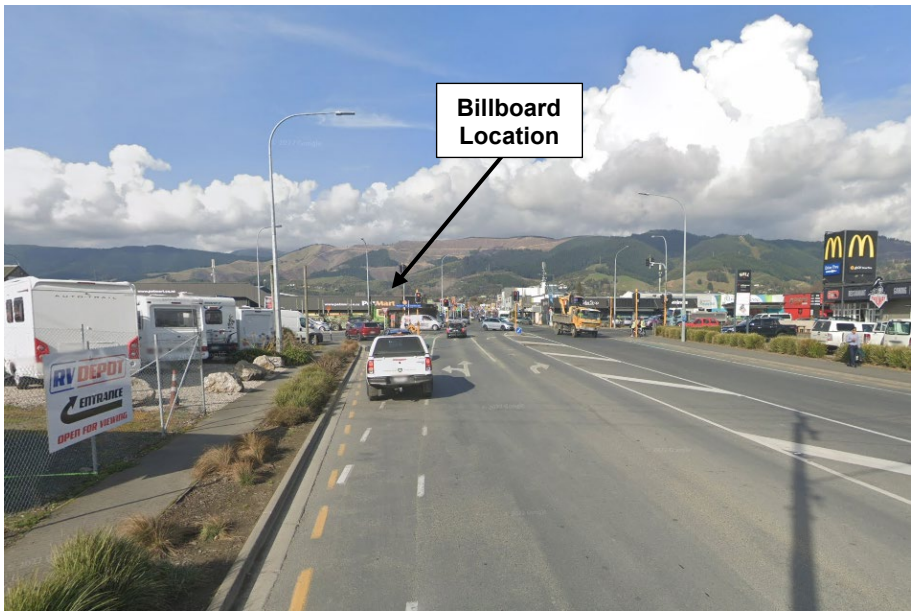

Figure 7: Lower Queen Street Approach to Intersection with Gladstone Road

4.6 There are four signal heads facing eastbound traffic (primary, dual primary, secondary and tertiary). There is a short, raised island of 10m on the approach.

4.7 The left-turn lane is not signalised and operates under give-way control although the give-way line is very worn. Pedestrians are able to cross this lane via a zebra crossing and there are standard carriageway markings (although I highlight that many of the stripes are barely visible) and Belisha Beacon discs. To enable pedestrians to wait to cross, and to ensure that

left-turning vehicles are aligned to the left, there is a raised island separating the left-turn lane from the 'straight ahead' lane.

4.8 As regards the traffic features of Lower Queen Street, I note that:

(a) There are footpaths on either side of Lower Queen Street.

(b) There are also on-road cycling facilities, with a northbound cycle lane and green surfacing provided, plus a corresponding southbound lane.

(c) There is direction signage for pedestrians and cyclists at the Gladstone Road / Lower Queen Street intersection, advising of the direction of the Brightwater and Wakefield walking/cycling route (which connects with Lower Queen Street approximately 85m northwest of the Gladstone Road / Lower Queen Street intersection).

(d) Lower Queen Street has one private access in the immediate vicinity of the Gladstone Road / Lower Queen Street intersection, which serves a McDonald's restaurant and drive-thru lane plus a small commercial development.

Traffic flows

4.9 NZTA carries out regular traffic surveys on the State Highway network which I evaluated in Section 2.2 of the ATM. However, as part of its submission, NZTA carried out a specific turning count at the Gladstone Road / Lower Queen Street intersection, and has made this available to Bekon. I summarise the morning and evening peak hour traffic flows below.

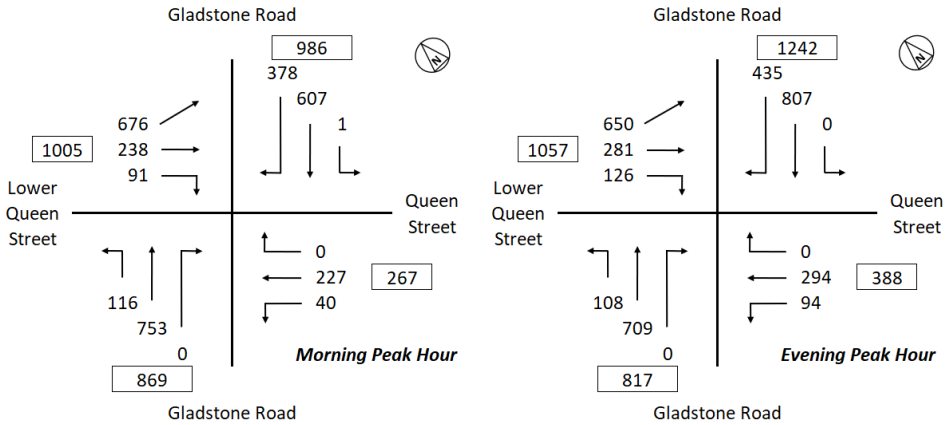

Figure 8: NZTA Observed Traffic Volumes

4.10 The figures in the smaller boxes represent the total number of vehicles approaching on each leg of the intersection. The other figures represent the number of vehicles making the turn.

4.11 These numbers demonstrate that Lower Queen Street is a busy approach, with more traffic using this in the morning peak hour than approaching on the State Highway. The majority (around two- thirds) of the vehicles approaching on Lower Queen Street turn left using the slip-lane, but as noted above, the proposed billboard has been reorientated such that it lies outside the viewing angle for this traffic.

4.12 In my experience, it is rare that the turning movement on a district road is higher than the traffic on a State Highway, and I have therefore checked this with on-site observations via a short-period traffic count of the left-turn slip lane carried out in September 2024. My observations aligned with the NZTA survey. Consequently, I adopt the NZTA traffic volumes for the purposes of my assessment as necessary.

Crash history at the site

4.13 In Section 2.3 of the ATM, I discussed the reported crashes that have occurred within 100m of the location of the proposed billboard location and in locations from where the proposed billboard could be seen, extracted from the NZTA Crash Analysis System (**CAS**). Over the period of 2019 to 2023 plus the partial record for 2024, there were 21 crashes reported within 100m to the north and west of the proposed billboard's location.

4.14 Since that time:

(a) The proposed billboard has been reorientated so that the left-turn slip lane lies outside the viewing angle of the billboard. The crashes that occurred from this location are no longer relevant and I have removed them from the analysis.

(b) I have also eliminated the crashes that occurred on Lower Queen Street at more than 21m from the stop-line, as when a driver is more than 21m away, they are outside the viewing angle of the billboard.

4.15 This results in a total of 14 recorded crashes that are relevant to this my assessment.

4.16 The ATM was produced in May 2024, and therefore included a partial record for 2024. In preparing my evidence I have taken the opportunity to review whether any additional crashes have been recorded within the NZTA CAS

database since May 2024. My review shows that the last reported crashes in the database both occurred in January 2024 and nothing further is in the database.

4.17 I discuss the crash record of the intersection in more detail later in this statement. I also highlight that crashes are not necessarily immediately recorded in CAS as there is a delay in their inclusion. However, fatal crashes are recorded in the CAS database within one day and injury crashes are recorded within one month, meaning that there can be confidence that there have been no injury crashes in 2024 up to the end of July 2024. However, non-injury crashes are presently taking up to 7 months to include[1].

4.18 Of the 14 relevant reported crashes:

(a) Three crashes were associated with drivers disobeying the signage and attempting to turn right in locations where there is a prohibition on this movement, as follows:

(i) Two crashes occurred when a driver turned right from Gladstone Road into Queen Street and was struck a westbound vehicle on Richmond Deviation. The crashes did not result in any injuries.

(ii) One crash occurred when a driver turning right from Queen Street was struck by a southbound driver on Lower Queen Street. The crash resulted in serious injuries.

(b) Three crashes occurred on the Gladstone Road approach, as follows:

(i) Two crashes occurred when an eastbound driver on Gladstone Road ran into the rear of another vehicle in a queue of traffic. One crash resulted in minor injuries and one crash did not result in any injuries.

(ii) One crash occurred when a driver changed lanes on Gladstone Road and struck the trailer of car ahead. The crash did not result in any injuries.

(c) One crash occurred on the Lower Queen Street approach.

(i) This occurred when a car going straight ahead into Queen Street failed to stay in their own lane and struck a truck that

[1] https://www.nzta.govt.nz/safety/partners/crash-analysis-system/ accessed on 15/08/24.

was turning right onto Gladstone Road. The crash did not result in any injuries.

(d) Four crashes involved drivers failing to stop at red traffic signals, as follows:

(i) One crash occurred when an eastbound vehicle on Gladstone Road failed to stop for a red signal and struck by a southbound vehicle on Lower Queen Street. The crash did not result in any injuries.

(ii) One crash occurred when a westbound vehicle on Richmond Deviation failed to stop for a red signal and struck a southbound vehicle on Lower Queen Street. The crash resulted in minor injuries.

(iii) One crash occurred when a westbound vehicle on Richmond Deviation failed to stop for a red signal and struck a northbound vehicle on Queen Street. The crash did not result in any injuries.

(iv) One crash occurred when an eastbound vehicle on Gladstone Road was struck by a northbound vehicle on Queen Street which had not stopped at a red signal. The crash did not result in any injuries.

(e) Three crashes occurred due to turning movements out of Lower Queen Street, as follows:

(i) One crash occurred when a southbound driver on Lower Queen Street entered the intersection on an orange signal, turned right and collided with a vehicle travelling north. The crash resulted in minor injuries.

(ii) Two crashes occurred when a southbound driver on Lower Queen Street turned right onto Gladstone Road, and failed to see a vehicle travelling north. The crashes resulted in minor injuries.

4.19 Viewed overall, the crashes typically had different contributing factors and occurred in different locations. Crash types such as nose-to-tail collisions in queues of traffic, and drivers undertaking turning movements when having a red or orange signals are common at busy urban intersections in my experience. The crashes are discussed further below.

Existing signage in the area

4.20 Based on my site visits, there are a small number of existing statutory road signs within 100m of the proposed billboard in locations where the road sign can be seen/read at the same time as the proposed billboard. These comprise:

(a) RG-6 'give way' signs at the southern end of the left-turn lane on Lower Queen Street;

(b) RG-7 'no right turn' signs facing west and affixed to three signal poles and at the eastern end of the raised island on Gladstone Road;

(c) RG-17 'keep left' single disc signs on the ends of the raised islands on Gladstone Road and Lower Queen Street;

(d) PW-5 'diverge' signs at the northern end of the island separating the left-turn lane from the straight head lane on Lower Queen Street';

(e) PW-30 'pedestrian crossing' sign on Lower Queen Street (approximately 95m from the proposed billboard location); and

(f) Belisha beacon discs at the zebra crossing in the left-turn lane on Lower Queen Street.

4.21 There is also a considerable number of roadside advertising signs on this part of the roading network, defined by TCDM3 as "*all advertising signs and devices which can or are intended to be seen by all road users*". These include (but are not limited to) sign faces on the properties fronting the road due to the commercial nature of the land use zoning, flags at the car yard on the northwestern side of the intersection, and plinth-type signs with shop names on the southern and western sides of the intersection. There are also flashing lights at the Salvation Army shop.

Figure 9: Examples of Other Signage near the Proposed Billboard Location

5. BILLBOARD ROAD SAFETY ASSESSMENT CONSIDERATIONS

Overview of research

5.1 Section 3.2 of the ATM set out a review of several research papers that have assessed the road safety effects of digital billboards. This section represents a brief overview summary, as I am aware of at least 80 papers that evaluate the potential road safety effects of digital billboards.

5.2 By way of an overview, one document is a 2013 research report produced by the Austroads organisation[2]. In passing, it is worth noting that this is a research report which does not have the same status as the typical Austroads guides that are commonly referred to by traffic engineers. More importantly, however, the guide itself states that it deals with all types of roadside advertising from static billboards to those that have animation, interact with a driver and those which are projections of large images onto buildings (as set out in Section 3 of the report). The present application does not seek to authorise animation, driver interaction and large-scale projections which will be precluded by standard and well-tested consent conditions.

5.3 The Austroads report is based on the information that was available at the time, and adopts a cautious approach in drawing any conclusions noting that:[3]

> *"There is compelling evidence that distraction is a major contributor to crashes. However, studies providing direct evidence that roadside advertising plays a significant role in these distraction based crashes are currently not available. The studies that have been conducted show convincingly that roadside advertising is distracting and that it may lead to poorer vehicle control. However, the evidence is presently only suggestive of, although clearly consistent with, the notion that this in turn results in crashes.*
>
> *It is also worth noting, on the basis of Klauer et al.'s (2006) results, that while looking at an external object increased the crash risk by nearly four times, less than 1% of all crashes and near crashes were from this source of distraction. A substantial proportion of these external objects would not have been advertising signs. Thus, while it is not possible to tell from the reported results, it is reasonable to conclude that far less than 1% of all crashes and near crashes involved distraction from roadside advertising.*
>
> *While the Klauer et al. (2006) study may not be representative of all driving events, it does suggest that the*

2 Austroads Research Report AP-R420-13, "Impact of Roadside Advertising on Road Safety" Section 3).

3 Austroads Research Report AP-R420-13, "Impact of Roadside Advertising on Road Safety" Section 5.2

> *contribution of roadside advertising to crashes is likely to be relatively minor."*
>
> (My emphasis.)

5.4 Another report is that of Horberry et al from 2009[4], which concludes that:

> *"There is still a lack of comprehensive research evidence upon which to form guidelines or standards about how much distraction from outside of the vehicle is 'safe'. A recent review in the UK of the driver distraction literature (in-vehicle and external distraction) produced similar conclusions, and recommended that further work to examine driver distraction due to the presence of advertising billboards and similar is a high priority. At the time of writing, similar research initiatives in the area of possible distraction caused by roadside advertisement are also taking place in the USA. However, until complete, the regulation of some types of information (e.g. billboards and other 3rd party advertising) in the road environment cannot be fully evidence-based."5*

5.5 In my view, this paper highlights that:

(a) There is insufficient research on which to base conclusions regarding the safety of roadside advertising; and

(b) An element of judgement is required.

5.6 That said, it is relevant to note that this paper was produced over 15 years ago and more research has been conducted since that time. The conclusions of the report therefore may not represent current thinking (either for or against digital billboards).

5.7 Subsequent to the Horberry paper, I am aware that there has been further research which sets out that in complex situations, drivers pay little heed to billboards but instead focus on the matters pertaining to driving[6 7 8 9].

4 Perez, Horberry, T., Regan, MA, & Edquist, J. (2009). Driver Distraction from Roadside Advertising: The clash of road safety evidence, highway authority guidelines, and commercial advertising pressure.

https://document.chalmers.se/download?docid=653291678

5 Ibid, page 6

6 Driver Visual Behavior In The Presence of Commercial Electronic Variable Message Signs (CEVMS), FHWA, 2011

7 Decker, JS et al (2015). The Impact of Billboards on Driver Visual Behavior: A Systematic Literature Review, Traffic Injury Prevention Vol 16(3), 234-239

8 Young, KL et al (2017). Investigating the Impact of Static Roadside Advertising on Drivers' Situation Awareness, Applied Ergonomics, Vol 60, 136-145

9 Young, K. & Regan, M. (2007). Driver distraction: A review of the literature. In: I.J. Faulks, M. Regan, M. Stevenson, J. Brown, A. Porter & J.D. Irwin (Eds.). Distracted driving. Sydney, NSW: Australasian College of Road Safety. Pages 379-405.

5.8 The Canadian Digital and Projected Advertising Displays: Regulatory and Road Safety Assessment Guidelines (TAC 2015) concludes that:[10]

> *"…despite years of research, there have been no definitive conclusions about the presence or strength of adverse safety impacts of digital billboards measured by increased collision frequency."*

5.9 Moreover, the purpose of the Canadian guidelines is to provide recommendations that are designed to control (digital billboards) such that they "*emulate static advertising signs and therefore result in a similar distracting and road safety effect as static advertisements*". The conditions that are proposed as part of this application will achieve that objective in this instance.

5.10 Finally, I am aware of a review of primary research prepared by Dr Jerry Wachtel entitled *'Compendium of Recent Research Studies on Distraction from Commercial Electronic Variable Message Signs (CEVMS)*'. This does not contain any primary research itself but is a review of other primary research papers. Accordingly, I have obtained and reviewed most of the primary research papers themselves (I was unable to locate several). A summary of my review is shown as **Annexure A** to my evidence.

5.11 In brief, a number of the papers addressed operating characteristics that are not proposed here (such as animation), involved an operational methodology that is not proposed here (such as drivers being required to look at billboards), or took place on higher-speed or more heavily trafficked roads. Even then, many of those studies did not report any clear evidential links to a reduction in road safety. For the remaining studies, which are arguably more relevant to the current application, there was again no evidential link of a detrimental effect on road safety.

Applicability of research

5.12 When undertaking my review of literature, I have been mindful of the fact that simply because a piece of research concerns digital billboards and road safety, this does not axiomatically make it relevant / applicable to the current application.

5.13 The authors of some studies specifically limit the scope of their research in some way, such as due to the uniqueness of the roads assessed, the small

10 Section 2.1.4 of the Guide.

data set examined, or being careful to draw a distinction between billboards attracting attention versus creating distraction.

5.14 In other cases, it is evident that the prevailing environment assessed is different to that which is present for the current application.

5.15 Importantly, in many cases, the research is not clear whether the digital billboard included moving images or was solely static and, if static, how long the images were displayed for and how they transitioned between images. In this regard, I acknowledge that the research shows that animation, short dwell times and instantaneous changes of image can all create driver distraction. However, without knowing the manner of operation of the billboards considered in the studies, it is unclear whether the research outcome is directly applicable to the current application and therefore whether it can be given any weight in this specific context.

5.16 By way of example, one study cited is that of Sisiopiku, VP, Islam, M, Haleem, K, Alluri, P. & Gan, A. (2014)[11]. This compares the crash records upstream and downstream of digital billboards on high-speed roads in the USA. When the data is aggregated, it purports to show that the number of crashes on the section of road prior to the billboard (where the billboard can be seen by the driver) is greater than downstream (where the billboard is not visible).

5.17 However, at 50% of the sites assessed, the records showed that there were fewer crashes where the billboard could be seen than downstream of the billboard, with the outcomes reversed at the other 50% of the sites. This is not the consistent pattern that would be expected if drivers were distracted.

Under reporting of crashes

5.18 Finally, one other paper attempted to account for any effects arising from driver under-reporting of crashes involving distraction due to digital billboards[12]. In brief, this study involved a sample of 4,307 drivers who had been involved in a crash in the previous 12 months who were asked to fill in a web-based questionnaire about distractions during the crash. For each of

11 Sisiopiku, VP, Islam, M, Haleem, K, Alluri, P. & Gan, A. (2014). Investigation of the Potential Relationship between Crash Occurrence and the Presence of Digital Advertising Billboards in Alabama and Florida. *Proceedings of the Transportation Research Board (TRB) 94th Annual Meeting.*

12 Backer-Grøndahl, A., & Sagberg, F. (2009). "Relative crash involvement risk associated with different sources of driver distraction." Presented at the First international Conference on Driver Distraction and Inattention. Gothenburg, Sweden: Chalmers University.

the potential 13 distraction factors presented, the drivers indicated whether or not they were distracted by that specific factor at the time of the crash. 'Distracted by billboard' was one factor of the 13.

5.19 The authors concluded that:[13]

> *"Even though the results from this study indicate that looking at billboards and searching for addresses/street names are the distractions associated with highest accident risk, it is also important to look at the prevalence of the risk factor. These two factors were reported to have been distracting only 0.3 and 0.6 percent of drivers (i.e., in the whole sample) respectively. This means that, as measured by the rate to which billboards distract drivers, this is not a large risk factor from a population perspective. When considering the prevalence of the risk factors in addition to the relative accident involvement, talking with passenger(s) and attending to children in the back seat are the distraction factors that perhaps are most likely to make the largest contributions to the number of crashes".*

Conclusion on published research

5.20 Taken overall, my view is that the published research does not:

(a) Show a demonstrated link between the presence of digital billboards and an increase in the number of crashes recorded, for the way in which the billboard will be operated in this instance.

(b) Provide supporting arguments for any compelling link between adverse road safety effects and digital billboards. Rather, several studies note that, measured by the rate to which billboards distract drivers, it is not a large risk factor from a population perspective, compared to more mundane tasks such as talking with passengers.

Local road safety records

5.21 In evaluating the potential of digital billboards to result in adverse road safety effects, I have previously reviewed the incidence of reported crashes in New Zealand in the vicinity of such billboards. I have carried out three studies.

5.22 One study used CAS to review the number of reported crashes where distraction from advertising was reported as a factor. Undertaking this again for the purposes of this statement of evidence, I found that between 2012 and 2021 (inclusive), there were 31,435 crashes where the report records "*attention diverted*". Of these however, only 73 were recorded with "*attention diverted by advertising or signs*" (equating to 0.2% of the total).

13 Ibid, page 11

For clarity, this statistic relates to all types of advertising signs, not just digital billboards.

5.23 By way of comparison, 8.4% of these crashes involved "*attention diverted by passengers*", 9.9% involved "*attention diverted by other traffic*", and 3.2% involved "*distraction by console in-built features*".

5.24 I am aware that is it sometimes argued by opponents of digital billboards that perhaps drivers (or the recording police officer) do not report distraction from billboards as a contributing factor. As set out previously (in paragraphs 5.18 – 5.19), one research study looked into this and found that under-reporting of this nature was unlikely. In my view, this is further reinforced by the fact that of the crashes involving distraction, drivers (or the reporting police officers) had no apparent issues in reporting distraction from scenery (6.9% of the total), a satnav (1.8% of the total), insects/animals in the vehicle (2.5% of the total), or even distraction through eating, drinking or smoking (4.7% of the total).

5.25 A more substantial study, which I carried out, was to compare the crash rates at 14 billboard locations for the period before and after digital billboards were installed. This type of study does not rely on drivers reporting distraction from billboards; rather, it is simply a matter of assessing the numbers of recorded crashes (with any/all possible reasons included).

5.26 Overall, 152 months of data were examined before and after installation, but no upward trend in crash numbers was observed - in fact, crash numbers decreased after the installation of digital billboards.

5.27 In presenting this study at a previous hearing, it was argued that perhaps the results masked an adverse road safety effect. That is, it was possible that although the results showed a decrease in crashes, perhaps if the billboards were not present then the decrease would have been even greater. Under that particular scenario, it was claimed, then the digital billboards may have had an adverse effect.

5.28 To address this, I carried out a study that refined the methodology. This looked at four digital billboard sites in Auckland that were installed at intersections and compared these with four nearby intersections that had static billboards and four nearby intersections that had no billboards. The study not only compared each site against each other, but also looked at each approach to each intersection, to see whether any statistically significant differences were present. No such differences were seen.

5.29 Despite the fact that this research was carried out in 2017, to my knowledge it remains the only research carried out of the actual outcomes of digital billboard installations in New Zealand.

5.30 At a more general level, there are now well over 500 digital billboards operating within New Zealand. This not only means that digital billboards are no longer a novelty and drivers will be well-used to seeing them as part of the roading environment, but it also means that there is now a large amount of data relating to crash numbers and patterns in the vicinity of the billboards.

5.31 As at October 2022, there were 486 large-format digital signs in New Zealand[14], plus a further 250 or so smaller screens in bus shelters. Adopting a conservative approach of each location having only 10,000 views per day (and most sites have considerably more than this because by their nature they are located on more highly trafficked roads), this equates to a cumulative total of more than 2.7 billion views per year. Allowing for the recent growth in digital billboards since the first one was installed in 2012, I estimate that there have been at least 5.5 billion views of digital billboards by drivers in total.

5.32 Despite this, a review of the Waka Kotahi CAS database shows there has been no reported crash in which distraction from a consented digital billboard has been cited as a contributing factor, and from my own research, there is no location in New Zealand where the number/rate of reported crashes has increased after a digital billboard has been installed compared to the number/rate of reported crashes prior to installation.

5.33 I refer to 'consented' digital billboards above because this is the area where I have carried out specific research. However, I am aware that in many locations in New Zealand, on-premise digital advertising that is able to be seen by drivers is not subject to the same controls as off-site advertising, with some even being a permitted activity. In my experience, these screens can include animation, instructions to drivers, flashing and representations of traffic signs. I am unaware of any adverse road safety effects arising from these (and they do not seem to raise concerns for NZTA or Councils), but I have not formally undertaken a more formal research study into these.

14 https://stoppress.co.nz/news/the-warehouses-nigel-the-nutcracker-takes-over-the-streets-of-aotearoa/

Figure 10: Example of on-premise advertising using animation facing drivers, State Highway 6A (Queenstown)

5.34 In summary, then, my own research into this matter shows no clear evidence of a systematic increase in crash rates due to digital billboards.

Overall conclusions

5.35 Based on my review, the available literature is sometimes inconsistent (if not contradictory) and, in a number of cases, not necessarily or directly relevant. It appears possible that digital billboards *might* attract driver attention to a greater extent than static billboards[15] although even this conclusion must be interpretated cautiously as some cases it is unclear from the literature how the billboard was operated (in particular, the dwell time for images, the brightness and the use of animation).

5.36 Even if this was the case though, the extent of any change in driver gaze patterns is not sufficient to result in a consequential increase in the crash rate. To paraphrase, <u>if</u> digital billboards attract more driver attention, this is not to the extent that a road safety problem arises.

5.37 Further, my research into the road safety effects of digital billboards in a New Zealand context does not show that crash rates increase once a billboard is installed. Rather, there is no statistical difference observed.

15 I say "might" because I am aware of one study shows that billboards are not looked at by 50% of drivers.

5.38 In my opinion, one plausible explanation for this outcome relates to the way that digital billboards are controlled in respect of their operation in New Zealand. That is, the factors that overseas studies show can potentially have an adverse effect on road safety (for example, animation) are addressed in New Zealand through conditions of consent to eliminate (or substantially mitigate) this characteristic.

6. COMPLIANCE WITH TCDM3 GUIDELINE

6.1 My assessment has considered the TCDM3 guideline (which to be clear is not a set of rules, standards or regulations) on roadside advertising, including billboards. As a preliminary comment, I note that TCDM3 states that:

(a) Each particular installation should be assessed on its own merits, with an expectation that sound judgement is used to ensure they are effective but without compromising safety; and

(b) There is no reason why an off-site advertising sign should have more of an adverse effect than a similar on-premise sign, provided suitable controls are in place.

6.2 As assessment of the application in light of the relevant TCDM3 considerations is provided below.[16]

Billboard location

6.3 The proposed billboard will be sited on private property beyond the boundary of Queen Street and elevated well above the carriageway surface. Consequently, it will not present a hazard in terms of physically blocking the visibility of any road signs for approaching drivers.

6.4 Gladstone Road in this location is subject to a 50km/h speed limit and therefore is classified as a 'urban' road under TCDM recommendations because of the speed limit. As such, there is a recommendation to have a 100m separation between a billboard and any permanent regulatory/warning signs and any intersections. The rationale for this distance appears to be that a billboard may obscure the traffic sign or otherwise detract from the effectiveness of the traffic sign.

[16] In passing, in 2022 NZTA issued an addendum to TCDM3 for assessing digital billboards. However this was subsequently withdrawn and so I do not refer to it within this part of my statement of evidence.

6.5 This distance is not achieved in this instance as there are a number of road signs in the vicinity as discussed above. That said, as the proposed billboard is elevated, it cannot obstruct the visibility or conspicuity of any of the road signs. Further, the signs are typically some distance from the proposed billboard and because of this, the road signs will appear more visually prominent than the proposed billboard. By way of example, as a driver approaches the intersection from Gladstone Road, the 'no right' turn signs will be closer to them then the proposed billboard, meaning at (say) 50m the road signs will appear to be one third the height of the proposed billboard.

6.6 Further, in my experience, there are numerous locations within New Zealand where billboards (both static and digital) are within 100m of an intersection or other signage and where no adverse safety effects have arisen. For example, of the 14 sites that I reviewed as part of my own study into road safety effects near billboards, 10 were adjacent to intersections.

6.7 For the 50km/h prevailing speed limit, the proposed billboard is expected to be visible for at least 80m on the Gladstone Road approaches. This is achieved (and exceeded).

6.8 There is also a recommendation that billboards should be placed as close as possible to drivers' lines of sight. It is evident from Figures 5 and 6 above that approaching drivers need to turn their head very little to see the billboard.

6.9 Additionally, under TCDM3, roadside advertising signs are recommended to be a minimum of 50m apart although it is recognised that this may not be achievable in urban environments. In this instance, I note that there are numerous existing on-premise advertising signs on this part of the roading network where this separation distance is already not achieved, and I therefore consider that, in this respect, the proposed digital billboard does not introduce any new safety risk into the prevailing environment.

Sign face

6.10 Controls (through conditions of consent) are proposed to be imposed to ensure that the images displayed on the proposed billboards are not capable of being mistaken for a traffic control device or which could be misconstrued as providing instruction to drivers. Similarly, the surface of the signs can be constructed from materials that do not reflect light from the lamps of any vehicle on the road and the brightness of the sign can also be suitably controlled.

6.11 Under TCDM3, for a posted speed limit of 50km/h, the minimum letter height size is 75mm, with the primary message being at least 150mm in height. However, this part of TCDM3 is based upon an expectation that drivers are to be able to read the text whereas in practice it is common on advertising signs (of all types) to provide smaller text which is not intended to be read by drivers (for example, legal disclaimers) and which does not affect the ability of drivers to assimilate the primary message on the billboard.

6.12 In essence, very small text cannot be read by drivers as its size makes it illegible. In my view, this does not present any road safety concerns because drivers are able to perceive the main message and disregard small text.

Figure 11: Example of Advertising Showing Legal 'Small Print' (Bottom of Image)

6.13 Moving messages and flashing lights will also not be allowed under proposed conditions of consent.

6.14 It is proposed that the billboards will be operated in a manner which comprises a series of static images with a 30-second dwell time (discussed in more detail below) and a 0.5 second transition time or 'dissolve'. The TCMM3 recommendation to have a minimum time for separate displays of more than five seconds and to change from one display to another in under two seconds can be achieved. Animation will also not be allowed.

7. PROXIMITY OF TRAFFIC SIGNALS

7.1 As noted in Section 4 of this statement, there is a signalised intersection immediately west of the proposed billboard location. One matter that is commonly raised as a concern by road controlling authorities is that a visual overlap between a digital billboard and traffic signal head might mean that drivers are less able to see the traffic signals with a consequential road safety risk.

7.2 While in my experience there is no evidence to support this, I have nevertheless considered whether there would be any overlap.

7.3 Based on site visits, there are no locations on Gladstone Road where the proposed billboard appears in the background of the traffic signal heads. Rather, all traffic signal heads appear to the left of the proposed billboard for approaching drivers, plus the billboard is elevated above three of the five traffic signals.

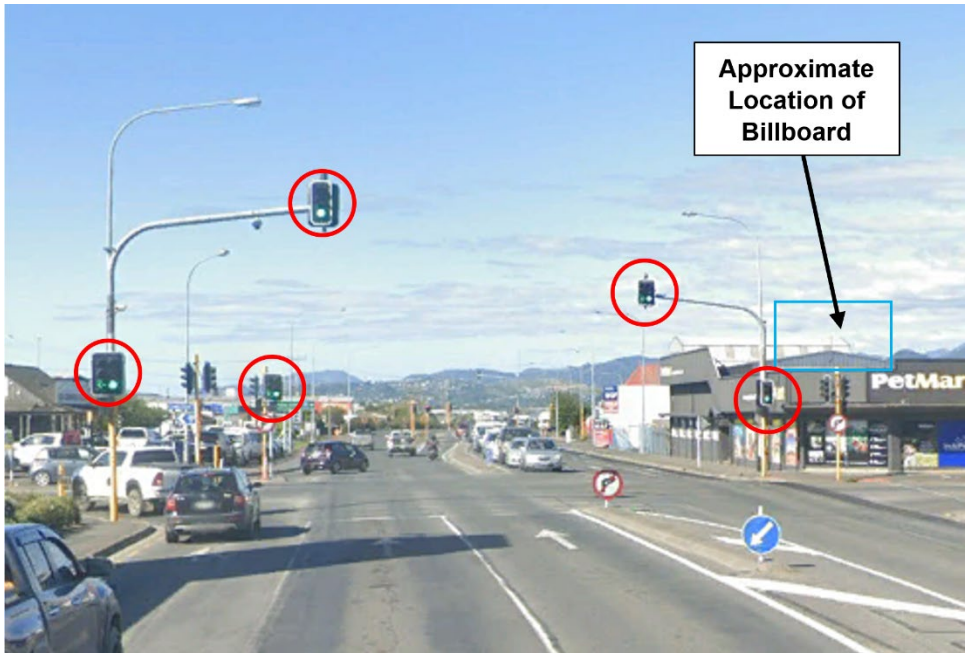

Figure 12: Traffic Signal Locations on Gladstone Road in Relation to Billboard Location

7.4 On the Lower Queen Street approach, as set out previously in paragraph 3.16, the proposed billboard lies outside the viewing angle for drivers but nevertheless, I have considered whether there would be overlap with any signals. I have therefore superimposed the location of the traffic signals where a visual overlap might arise, and then constructed lines of sign from each edge of the proposed billboard, through the position of each traffic signal.

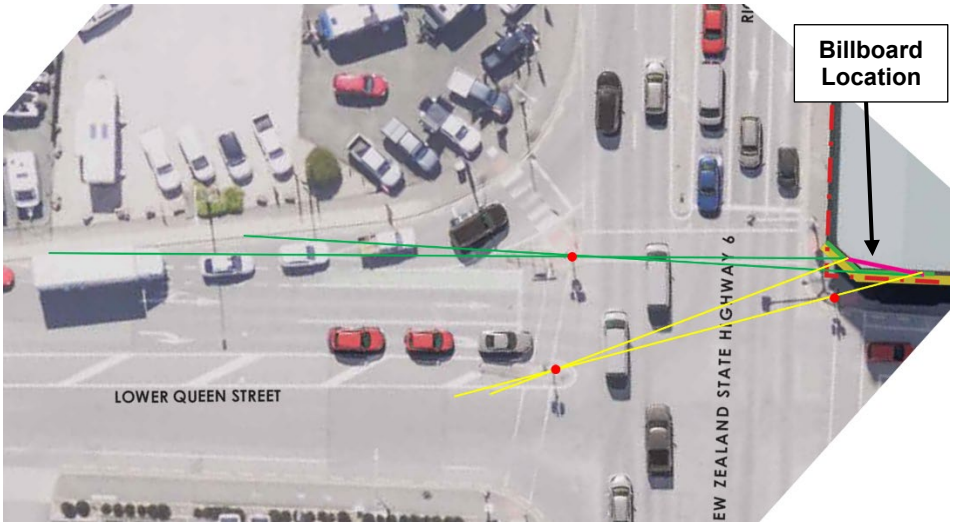

Figure 13: Potential For Overlapping with Signals on the Lower Queen Street Approach

7.5 This analysis shows that theoretically there is an overlap for drivers using the left-turn slip lane over a short distance. However as I set out previously in paragraph 3.16, at this point the billboard lies outside the viewing angle for drivers, plus these drivers pay no heed to the traffic signals because the left-turn lane is not signalised. Any potential overlap is therefore irrelevant for these drivers.

7.6 There is no visual overlap with any other traffic signal.

7.7 Considered overall, it is my opinion that there no objective reason to anticipate that the installation of the digital billboard will result in driver confusion with the traffic signals – rather the signals and the billboard are visually distinct.

8. ROAD SAFETY ASSESSMENT

8.1 As noted previously (at paragraphs 4.13 – 4.19) and in the ATM, 21 crashes have been reported in the vicinity of the billboard but 7 of these occurred in locations that are outside the viewing angle of the reorientated billboard.

8.2 I have reviewed the remaining crashes to identify whether they reflect an issue that could have been exacerbated if the proposed billboard was in place and note the following:

(a) For the three crashes associated with drivers disobeying the signage and attempting to turn right in locations where there is a prohibition on this movement, it is of note there are already four 'no right turn' signs plus carriageway markings advising drivers of the prohibited movement, plus as it is further away from drivers, the proposed

billboard would appear visually smaller than the road signs. The crash that occurred when a driver turning right from Queen Street was struck by a southbound driver on Lower Queen Street involved at at-fault driver that could not have seen the proposed billboard.

(b) The two nose-to-tail crashes that occurred on the Gladstone Road approach occurred some distance from the proposed billboard, and this type of crash is common in busy, urban areas.

(c) Crashes involving drivers failing to stop at red traffic signals is not uncommon at urban intersections, and only one (in five years) occurred in a location where at the at-fault drivers could have seen the proposed billboard.

(d) One of the three crashes that occurred due to turning movements from Lower Queen Street took place when a southbound driver on Lower Queen Street entered the intersection on an orange signal and there is no indication that the driver failed to see this (simply that they disregarded it). For the remaining two crashes involving turning movements from Lower Queen Street, the movement means that the proposed billboard would move outside the drivers' field of vision prior to the collision.

8.3 Of the two remaining crashes not discussed above

(a) The crash involving a driver clipping a trailer on Gladstone Road is recorded as the at-fault driver simply failing to manoeuvre their vehicle correctly when overtaking. It is also possible that the vehicle towing the trailer slowed down which contributed to the crash.

(b) There is little information recorded regarding the other crash – why a driver failed to stay in their own lane and struck a truck (the incident was recorded on CCTV and tail-swing of the truck was not reported).

8.4 I am aware that this intersection has been cited as a location with a poor road safety record. I discuss this further below but, in brief, when considering the digital billboard those crashes which occurred in locations from where the proposed billboard cannot be seen are not a material consideration. In other words, if road users cannot see a billboard, there is no potential for the billboard to affect their behaviour.

8.5 Accordingly, taking into account the crashes recorded in locations where the proposed billboard lies within the viewing angle for drivers, I do not consider that the nature or frequency of reported crashes would be likely to be influenced by the presence of the proposed billboard.

9. PROPOSED CONDITIONS OF CONSENT

9.1 The conditions of consent that are proposed are important to ensure that the proposed billboard will be operated in a manner which does not lead to adverse road safety effects. In my view, the proposed conditions set out in the evidence of Ms Collie will achieve this outcome, but I discuss conditions of consent further in my response to the section 42A report.

9.2 I have given further consideration to the proposed dwell time. A dwell time of 8 seconds is the most common timing for digital billboards in New Zealand, and there is no evidence that this presents adverse road safety effects such as an increase in crashes. This is the reason why 8 seconds was proposed as part of the application.

9.3 As noted above, I do not consider that properly consented and operated digital billboards give rise to adverse road safety effects. However, I am also aware that in locations where road safety concerns have been raised, billboard operators have volunteered a longer dwell time (or a longer dwell time has been imposed by conditions).

9.4 With regard to the dwell time, NZTA representatives have advised that, in their view, the majority of drivers should only be able to see two changes of image at most. In practice, this would correspond to a driver seeing one change of image as they are first able to discern the image displays, and then a second change occurring just before the image passes outside their field of vision. This means that drivers that had already passed the point where they could first discern the image would only see one change of image.

9.5 A number of factors that are relevant to this, but two in particular are worthy of note:

(a) The size of the lettering. As letter height becomes larger, it can be seen from further away, meaning that for any given speed, there is a greater time between first seeing the image and passing the billboard. This suggests that a longer dwell time is needed to achieve NZTA's desired outcomes.

(b) The vehicle speed. As vehicles travel faster, there is less time between first seeing the image and passing the billboard. This suggests that the dwell time could be shorter while achieving NZTA's desired outcomes.

9.6 These two factors will frequently vary, even over the course of an hour. Under a scenario for an image with large text and a driver in congested conditions and travelling slowly, a long dwell time would be needed. However, if the image had smaller text and the driver was travelling more quickly, the dwell time could be shorter.

9.7 One relevant offsetting effect is that, at slow speeds, drivers have more time available to react to potential conflict and take avoiding action. In the event of a collision at slow speeds, there is also less likely to be an injury.

9.8 Advertisers ultimately wish to ensure that their images are noticed. The United States Sign Council has a 'best practice' guide which sets out the lettering height needed to be legible to assist advertisers in this[17], and this sets out that lettering that is 1 inch in height (2.54cm) can be read at distances of 25 to 37 feet (7.6m to 11.3m), depending on the style of lettering used.

9.9 TCDM3 sets out that within a 50km/h speed limit, the absolute minimum height of text on a billboard within a 50km/h speed limit area is 75mm. Applying the United States Sign Council approach indicates that this height of lettering means that the text would be legible at 22m to 33m away from the billboard, but no further. The minimum height of the primary message is expected to be 150mm under TCDM3, meaning that under the United States Sign Council approach it would be legible at 44m to 66m away.

9.10 However, TCDM3 also sets out that within a 50km/h speed limit, unobstructed views of billboards are expected at a distance of 80m. This distance is further away than the text would be legible, which may indicate a degree of conservatism in TCDM3 distances.

9.11 I have also considered another approach for assessing at which distance the image on a billboard might first be readable. A person with 20/20 (i.e., normal) vision in excellent lighting is able to read letters that subtend an angle of 5 minutes of arc[18]. This equates to 0.0833 degrees. I understand,

17 https://usscfoundation.org/wp-content/uploads/2018/03/USSC-Guideline-Standards-for-On-Premise-Signs-2018.pdf

18 https://en.wikipedia.org/wiki/Snellen_chart#:~:text=In%20the%20most%20familiar%20acuity,subtends%20one%20minute%20of%20arc

though, that this assumes perfect lighting conditions at a 6m viewing distance (which is standardised for the purposes of assessing eyesight). However, this would be unlikely for the billboard, since luminance decreases as the viewer is further from the billboard.

9.12 Nevertheless, using this approach, the minimum 75mm letter height of TCDM3 would be legible at 51m and at the minimum letter height for the primary message of 150mm, it could be read at 103m.

9.13 This then gives a range for reading images on the billboard of 66m to 103m, allowing for the minimum lettering size for the primary message under TCDM3 and depending on which methodology is used (the United States Sign Council or the first-principles approach for typical eyesight). As noted above however:

(a) The 103m distance is based upon the image being seen under ideal conditions, which is unlikely. This suggests that the practical viewing distance would be shorter than this.

(b) Conversely, while TCDM3 specifies the minimum size of the primary lettering, it does not specify a maximum size. If an image had larger lettering then it could be legible at greater distance than 103m.

9.14 On balance, then, taking into account the 'unders and overs', I have adopted the upper limit of the range (103m) for the practical viewing distance of the billboard.

9.15 In March 2022, NZTA issued an addendum report to TCDM3 addressing digital billboards. The addendum was withdrawn within a few months and has no legal effect, but one part of this related to considering dwell times. This set out an equation by which the dwell time could be calculated with "a maximum of 5% of drivers seeing one image change", found though the following equation:

Dwell time (s) = distance (m) x 6 / posted speed limit (km/h)

9.16 In this case, the equation shows that at the posted speed limit of 50km/h, and with text being legible at 103m, a dwell time of 12.4 seconds is appropriate.

9.17 I acknowledge that it could be argued that drivers may be travelling more slowly than this in practice. The TCDM3 addendum is specific in the use of the posted speed limit and not the actual operating speeds, but even if an

operating speed of (say) 25km/h is used, then a dwell time of 24 seconds would be found through the calculation.

9.18 In the context of this application, the proposed conditions provide for a minimum dwell time of 30 seconds. This is more than twice the duration that is appropriate in terms of the NZTA equation, and 25% more than the duration adopting a low operating speed, and therefore in my view it represents a conservative approach to the dwell time.

9.19 As a final note, I am unaware of any research that shows that 5% of drivers seeing one change of image represents a practical maximum prior to some sort of adverse effect arising, rather than (say) seeing two or three changes of image. There is certainly research that indicates extremely short dwell times give rise to extensive glances away from the roadway, but this is one reason why the typical approach in New Zealand is for each image to be displayed for a minimum of 8 seconds. This 8-second duration has not given rise to any adverse road safety effects.

9.20 On this basis, then, I consider that the use of a 12-second dwell time can be supported, or a 24-second dwell time would be appropriate if lower vehicle speeds are assumed. The Applicant's proposal for a 30-second dwell time represents a conservative approach to addressing this matter and will mean that fewer than 5% of drivers will see a change of image.

10. COMMENTS ON ISSUES RAISED IN THE COUNCIL OFFICER'S REPORT

10.1 I have reviewed the reports of Ms Woodbridge, consultant planner to Tasman District Council, who in turn relies upon the report of Mr Ari Fon, consultant traffic engineer to the Council. I largely address Mr Fon's comments as they inform Ms Woodbridge's opinions.

10.2 I am mindful that both Ms Woodbridge and Mr Fon have provided their comments based on the application as notified, rather than being modified through the reorientation of the proposed billboard, the installation of the parapet and the increased dwell time.

10.3 In his Section 5, Mr Fon discusses the crash records at the intersection. However, I note that his analysis adopts the total number of crashes (presented in a separate report), uses all crashes reported at the intersection and not just those from where the billboard could be seen. In my view it is self-evident that where road users are unable to see the proposed billboard, it cannot affect their behaviour or give rise to an adverse (transportation) effect.

10.4 The reorientation of the proposed billboard must by definition alter Mr Fon's assessment simply on the basis that, rather than two serious and six minor injury crashes, as he has used, the historic pattern shows that one serious and four minor injury crashes occurred in locations from there the proposed billboard could have been viewed by one or more of the road users involved. Of these though, one crash involved a driver failing to stop at the traffic signals on Richmond Deviation, and eliminating this would mean that the number of injury crashes reported is just 50% of those used by Mr Fon.

10.5 The same issue arises in relation to Mr Fon's second assessment which compares this intersection against other locations within the district – the relevant comparison is not the total number of crashes reported but only those from where the proposed billboard can be seen.

10.6 In discussing the literature review in his Section 6, Mr Fon includes an additional quote from sources that I have cited. I do not dispute this but, on my reading, the passage that he has cited does not preclude the installation of any infrastructure where increased driver distraction might arise, but that it should be done cautiously. I concur with this approach – it is important in my view that any street furniture or advertising is controlled, and before being approved, is carefully considered for its expected effects.

10.7 Mr Fon's view is that any non-compliance with TCDM3 are fundamental matters for consideration. I assessed these in the ATM.

10.8 The paragraphs on page 5 of Mr Fon's report have been superseded by the reorientation of the billboard, as they relate to Lower Queen Street and locations from where the proposed billboard can no longer be practically viewed. However, I note that Mr Fon did not make any comment on the Gladstone Road approach.

10.9 Section 9 of Mr Fon's report sets out his recommendations for conditions of consent. However, I have reviewed those conditions that are formally proposed through Ms Woodbridge's report as I understand that these have the more formal status.

10.10 In Condition 3, I note that the wording of "retro-reflective materials" has been included. While I agree that reflectivity on a billboard needs to be controlled from a road safety perspective, this is already addressed in the previous part of the condition which ensures that the proposed billboard shall be 'non-reflective'.

10.11 Condition 9 relates to dwell times. I have set out above that the Applicant offers 30 seconds for the dwell time, which I consider to be robust. Ms Woodbridge sets out that between 9pm and 6am, the dwell time shall be 30 minutes. It is unclear why this has been proposed, and it is not necessary to manage a road safety or other effect, where 30 seconds is ample over the whole day. In fact, given that traffic speeds will be greater during night-time, a shorter dwell time can be justified between 9pm and 6am, rather than a longer period.

10.12 I do not have any concerns with including the words "or other dynamic effects" in proposed Condition 11(a).

10.13 With regard to Condition 11(b) I note that the matter of whether an image could cause confusion with a traffic control device is proposed to be left to the opinion of the Council's Team Leader – Compliance and Investigation. Incorporating a non-expert opinion in consent conditions introduces uncertainty in my view, and I recommend this part of the condition is deleted. In my experience, the requirement for imagery not to replicate traffic control devices is common in consent conditions for digital billboards and is not unambiguous.

10.14 With regard to Condition 16, Ms Woodbridge adopts Mr Fon's proposal to change the timing of the road safety assessment to require reporting at six months. My concern with this change is that it can take up to six months for non-injury crashes to be recorded in the NZTA CAS database, meaning that any assessment after just six months may well not identify those crashes. For those reasons I prefer the proposed 12 months and 24 months, on the basis that the data set will be more robust.

10.15 In respect of the accompanying Advice Note, the mitigation measures suggested are not mandatory and so in my view the suggestion for conversion to a static billboard is not a necessary addition.

11. COMMENTS ON SUBMISSIONS

11.1 I have read the submissions received on the proposal, and comment below. Note that these are not listed in any particular order, and where the same point is made in more than one submission, I have responded only once. In some cases the points made are addressed more fully previously in my statement of evidence, and in these cases, I have only briefly commented below.

11.2 I have however considered the submission of NZTA separately. The reason for this is that NZTA has provided a greater level of technical detail than other submitters, and thus the extent of assessment needed to respond is also greater.

Submitter concern: There will be adverse effects on road safety

11.3 My assessment shows that where digital billboards have been consented and are operational, there are no identifiable adverse road safety effects.

Submitter concern: The digital billboard will add to the complexity of the roading environment

11.4 The proposed billboard has been reoriented such that the viewing angle faces Gladstone Road and the section of Lower Queen Street close to the stop-lines. Drivers in these locations are already able to see numerous other roadside advertising and the proposed billboard will form just one element in the overall streetscape.

Submitter concern: The digital billboard will adversely affect the operation of the left-turn lane from Lower Queen Street

11.5 The proposed billboard has been reorientated such that the left-tun slip lane lies outside the viewing angle.

Submitter concern: There will be adverse effects on cyclists using the cycle trail

11.6 The cycle trail runs to the west of the proposed billboard location, and the reorientation of the proposed billboard means that the trail lies outside the viewing angle.

Submitter concern: There will be adverse effects on pedestrians (including students walking to school and the elderly)

11.7 I anticipate that this concern relates to pedestrians crossing the road at the intersection rather than to them walking along the footpath. As such, the issue becomes whether drivers will fail to stop at the traffic lights due to gazing at the proposed billboard.

11.8 At a general level, there is no evidence that driver looks towards billboards to such an extent that they fail to stop at traffic signals. However, due to the reorientation of the proposed billboard, this issue could only arise on Gladstone Road, as at the point where images start to become legible on

Lower Queen Street, drivers will have already decided whether to stop or not.

11.9 On Gladstone Road, drivers are presented with five traffic signals directly in front of them, whereas the proposed billboard will be elevated and positioned to the drivers' right, providing a clear visual differentiation between the proposed billboards and the traffic signals, and making it very unlikely that drivers would fail to see or understand the traffic signals.

Submitter concern: Drivers will be distracted and fail to stop at red signals

11.10 I address this concern in the paragraphs immediately above.

Submitter concern: The intersection already has a high crash rate that will be exacerbated further

11.11 I discuss this in more detail above.

Submitter concern: Drivers will slow down to look at the billboard, further contributing to congestion

11.12 There is no evidence that drivers slow down to look at billboards where the image is displayed for an extended period of time. I acknowledge that there is evidence that if the image was displayed for a short period of time (less than 5 seconds), or is animated, or that images are shown in a sequence where understanding one image requires seeing the previous image, drivers have been observed to slow down. However, all of these factors are prohibited through conditions of consent.

12. COMMENTS ON NZTA SUBMISSION

12.1 NZTA's submission is more comprehensive, and I therefore deal with it separately. In making comment though, I am aware that their submission was made before the billboard was reorientated, the parapet added and the dwell time was increased.

12.2 NZTA seeks the provision of additional viewpoints for drivers approaching the billboard. These have been produced by DCM Urban and are attached to the statement of evidence of Mr Compton-Moen. I have reviewed these and, in my view, they demonstrate that for a driver approaching the intersection, the billboard simply forms one element within their field of vision. It is evident that in each case, there is existing roadside advertising already present within the drivers' cone of vision.

12.3 In their paragraph 12, NZTA states that billboards increase the risk of crashes, and raise concerns regarding the current road safety record of the intersection. I discuss this previously (at paragraphs 4.13 – 4.19 and in Section 8), but in essence I remain of the view that the relevant crashes are those that have occurred where the billboard could have been viewed rather than those in locations where it is not seen.

12.4 Paragraph 13 of NZTA's submission relates to the dwell time. I confirm that this has now been increased from 8 to 30 seconds.

12.5 In paragraphs 15 to 19, NZTA discusses the potential road safety effects on the left-turn slip lane. The billboard has now been reorientated to mean that drivers cannot view images on the billboard when turning in this location.

12.6 Paragraphs 20 to 27 of the submission relate to the available literature. I have not undertaken a point-by-point rebuttal of this, but I agree that "it is not possible to conclude that there is a direct relationship between driving behaviour changes attributed to roadside advertising and road crashes" and that "most studies remain inclusive". I also agree that most empirical studies have methodological limitations and that it is important to act with caution. This precautionary approach is the reason why the location has been carefully assessed and examined, and as a result of additional information and discussion with NZTA, the proposal has been modified.

12.7 I have not discussed NZTA's commentary around pedestrian crossings, on the basis that the billboard has now been reoriented away from this. However, I note that NZTA cites a study by Mollu et al from 2018 and notes that this shows that drivers glance more towards billboards where the dwell time is shorter. While this conclusion is not incorrect, the effects where Mollu observed increased glances occurred with dwell times of three seconds and six seconds. Such short dwell times are not used in New Zealand (in fact one reason for the commonly-used eight-second dwell time is to mitigate against excessive driver glances). Moreover in this case, the proposal is includes a 30-second dwell time, considerably more than studied by Mollu.

12.8 On my review of NZTA's submission, the orientation of the billboard and increased dwell time address the bulk of their issues which they have raised.

Andy Carr

17 October 2024

ANNEXURE A

Backer-Grøndahl, A., & Sagberg, F. (2009). "Relative crash involvement risk associated with different sources of driver distraction." Presented at the First international Conference on Driver Distraction and Inattention. Gothenburg, Sweden: Chalmers University.

Summary: A sample of 4,307 drivers who had been involved in a crash in the previous 12 months filled in a web-based questionnaire about distractions during the crash. For each of the potential 13 distraction factors presented, the drivers indicated whether or not they were distracted by that specific factor at the time of the crash. 'Distracted by billboard' was one factor of the 13.

"Even though the results from this study indicate that looking at billboards and searching for addresses/street names are the distractions associated with highest accident risk, it is also important to look at the prevalence of the risk factor. These two factors were reported to have been distracting only 0.3 and 0.6 percent of drivers (i.e., in the whole sample) respectively. This means that, as measured by the rate to which billboards distract drivers, this is not a large risk factor from a population perspective.

When considering the prevalence of the risk factors in addition to the relative accident involvement, talking with passenger(s) and attending to children in the back seat are the distraction factors that perhaps are most likely to make the largest contributions to the number of crashes"

Belyusar, D., Reimer, B., Mehler, B., & Coughlin, JF. (2016). "A field study on the effects of digital billboards on glance behavior during highway driving." Accident Analysis and Prevention, 88, 88-96.

Summary: The study reports the glance and driving behaviour of 123 drivers who were exposed to two digital billboards on a segment of an eight-lane (four lanes in each direction) highway subject to a100km/h speed limit. Other than the billboards, the highway was largely free from extraneous signage.

"The results presented in this report require further confirmation in different environments to establish the generalizability of findings. However, combined with previous literature, they clearly suggest that digital billboards alter driver attention. The degree to which this diversion of attention impacts safety is not clear."

Bendak, S., & Al-Saleh, K. (2010). "The role of advertising signs in distracting drivers." ***International Journal of Industrial Ergonomics, 40,*** **233-236.**

Summary: Twelve volunteers (all male) were asked to use a car simulator to drive around a 9.3km route and five metrics were observed - their tendency to drift from their own traffic lane, recklessly crossing dangerous intersections, not signalling, speeding and tailgating. In the presence of roadside advertising there were statistically significant differences with drifting from their own traffic lane and recklessly crossing dangerous intersections but not the other three metrics.

"In this current study, roadside advertising signs refer specifically to electric signs (which are illuminated by internal lights), animated signs (which refer to any sign that moves or gives the effect of a moving display), banners (which are portable signs usually made of fabric), shop fronts, billboards (that consist of a number of standard-sized poster panels) and changing message signs (which are animated signs consisting of messages changing in sequence). These signs can be located within the road boundaries, on private property near the road or mounted on vehicles."

Comment: It is not clear in the study whether the roadside advertising used in the simulator was solely limited to billboards or included full motion and/or other types.

Chan, E., Pradhan, AK, Knodler, MA, Jr., Pollatsek, A. & Fisher, DL. (2008). "Empirical Evaluation on a Driving Simulator of the Effect of Distractions Inside and Outside the Vehicle on Drivers' Eye Behaviors," Washington, DC: 87th Annual Meeting of the Transportation Research Board of the National Academies.

Paper could not be sourced

Chattington, M., Reed, N., Basacik, D., Flint, A., & Parkes, A. (2009). "Investigating Driver Distraction: The Effects of Video and Static Advertising." Report No. RPN256. United Kingdom: Transport Research Laboratory

Summary: This study compared video billboards (defined as billboards where animation or full motion is shown, and akin to a television) to static billboards (where there is no movement), using a sample of 48 drivers and a driving simulator.

"This study set out to investigate the relative level of driver distraction caused by a range of billboard advertising configurations with a particular focus on the effect of video adverts compared to static adverts"

"While it is clear there are some effects of position and duration of exposure, the main findings is that video adverts provide a greater distraction than that currently caused by drivers approaching equivalent static adverts"

Comment: It is not considered that this study is particularly relevant since it addresses only digital billboards displaying full motion.

Divekar, G., Pradhan, AK, Pollatsek, A., & Fisher, DL. (2013). "External Distractions": Evaluations of their effect on younger novice and experienced drivers' behavior and vehicle control." Transportation Research Record, Journal of the Transportation Research Board No. 2321. Washington, DC: Transportation Research Board of the National Academies.

Summary: This paper discusses the potential for long glances away from the forward roadway create safety problems. The methodology used was to compare 24 novice drivers and 24 experienced drivers as they drove a car simulator and were engaged in a task of counting the number of times that a specific letter appeared within a 5 x 5 grid of letters presented to them in the form of a (simulated) roadside billboard. Metrics such as speed, lane deviation, braking and acceleration were measured. There were 11 such grids on a 4.3km long route (one grid every 390m).

"The major finding was that the long glances of both experienced and novice drivers came at the cost of identifying potential hidden hazards and seeing exposed moving threats."

Comment: It is not considered that this study is particularly relevant to digital billboards since it relates to distractions of all types outside the vehicle.

Dukic, T., Ahlstrom, C., Patten, C., Kettwich, C., & Kircher, K. (2012). "Effects of Electronic Billboards on Driver Distraction." Journal of Traffic Injury Prevention, *14,* 469-476.

Summary: The study used a sample of 41 drivers in Sweden to drive a route passing four electronic billboards during day and night conditions. A driver was considered visually distracted when looking at a billboard continuously for more than 2 s or if the driver looked away from the road for a high percentage of time. The amount of time that they looked at the billboards was compared to the amount of time spent looking at standard road signs.

"To conclude, electronic billboards appear to have an effect on gaze behavior because they attract more and longer glances than standard road signs. Whether they attract too much attention and constitute a bona fide traffic safety hazard cannot be answered conclusively based on the present data"

Edquist, J., Horberry, T., Hosking, S. & Johnston, I. (2011). "Advertising billboards impair change detection in road scenes." Paper presented at the 2011 Australasian Road Safety Research, Education & Policing Conference.

Summary: The study used a sample of 45 drivers to view photographs of road scenes on a screen, with an image of a scene displayed for 0.4 seconds, before a second image was shown for the same period of time. The first image was then displayed again, followed by the second image and so on. The was essentially the same, except that one of the pair had been modified such that a car, a road sign, or some other item was missing or its size had been changed. Participants were required to identify the nature of the change in the fastest time possible. However, some of the pairs of images included static billboards and some did not.

"When both built and designed clutter were high, adding billboards did not have a significant effect on time to detect change. When built clutter was high but designed clutter was low or vice versa, drivers took longer to detect changes in scenes with billboards than in scenes without billboards. When both built and designed clutter were low, drivers were faster to detect changes in scenes with billboards"

(Note: "designed clutter" is defined as built clutter is the objects that road authorities use to communicate with the driver, such as road markings, traffic signs and signals. "Built clutter" is buildings and other infrastructure, shop signage etc that make the scene visually complex)

"The present study is limited in that it did not include a driving task, merely a surrogate measure for visual subtasks required during driving."

Gitelman, V., Zaidel, D., & Doveh, E. (2012). "Influence of Billboards on Driving Behavior and Road Safety," Presented at: Fifth International Conference on Traffic and Transportation Psychology. Groningen, The Netherlands: University of Groningen.

Summary: The paper presents an analysis of the impact of advertising billboards adjacent to the Ayalon Highway (Israel) on the occurrence of crashes on that highway. Two periods are compared: "before" – when the billboards were present along the roadside (years 2006-2007) and "after" - when the billboards were covered (2008). A literature survey is also included.

"The literature survey shows that both early and recent studies found a negative impact of advertising billboards on safety. However, a critical analysis of the studies reveals that many studies were not methodologically adequate. Recent studies were more rigorous, and while the findings were also in the same direction, the results were often not statistically significant."

"Laboratory experiments, including simulator studies, have shown deteriorating driving performance in the presence of advertising billboards and messages, especially dynamic advertising media. However, the findings of field studies do not provide consistent evidence for the negative effects of billboards on driver behaviour"

"Due to reservations regarding the data, the uniqueness of the Ayalon Highway and the Treatment characteristics, it is recommended not to attach undue weight to the (relative large) derived statistical value for the percentage reduction in accidents following the removal / cover of advertising billboards. However, the downward trend in accidents in the "after" period was robust and consistent, in all examinations, particularly for injury crashes. Therefore we can conclude that under Israeli road conditions, there is empirical evidence of a link between the removal of advertising signs and the improvement of road safety on an urban / suburban highway."

Gitelman, V., Zaidel, D., Doveh, E., & Zilberstein, R. (2014) "The Impact of Billboards on Road Accidents on Ayalon Highway Three Periods Comparison – Billboards Present, Removed, and Returned." Report to the Israeli National Road Authority.

Summary: As per the above, except that an additional data set is included – of the crash records over 3.5 years when the billboards were returned

Ayalon Highway "*is used as a local, metropolitan, and national level traffic route. • 21 interchanges (rather dense). 750, 000 vehicles travel it daily. Trains run in parallel to the highway*"

"Ayalon Highway carries high volume of traffic and has high density of interchanges generating frequent need for lane changes and speed adjustment"

"Advertising industry, Lobbyists and Politicians argued for or against roadside advertising. No side in the debate could present compelling accident data"

Hawkins, HG, Jr., Kuo, PF, & Lord, D. (2014). "Statistical Analysis of the Traffic Safety Impacts of On-Premise Digital Signs." Paper No: 14-2772. Presented at the 93rd Annual Meeting of the Transportation Research Board.

Summary: A total of 135 on-premise digital signs were identified, and the number of crashes which occurred before and after the sign was installed were compared. Three to four years of 'before' data plus three to four years of 'after' data were used. Control sites were used to account for changes in crashes unrelated to the presence of the sign.

"The results show that there was no statistically significant change in crash frequency associated with the installation of on-premise digital signs. Thus, there seems to be no evidence the installation of on-premise signs at these locations led to an automatic increase in the number of crashes".

Herrstedt, L., Greibe, P. & Andersson, P. (2013). "Roadside Advertising Affects Driver Attention and Road Safety." ***Proceedings of the 3rd International Conference on Driver Distraction and Inattention, Gothenburg, Sweden.***

Summary: The purpose was to study whether static roadside advertising in rural areas captures and keeps drivers' attention to the extent that it affects driver behaviour and thereby traffic safety, using a sample of 32 drivers on high speed roads.

"The roadside advertising signs were selected amongst the most striking conventional rural roadside advertising signs"

Comment: It is not considered that this study is particularly relevant as it solely addresses billboards on high speed rural roads, where other research shows drivers tend to be attracted to the billboard due to a lack of other stimuli.

Horberry, T., Regan, MA, & Edquist, J. (2009). Driver Distraction from Roadside Advertising: The clash of road safety evidence, highway authority guidelines, and commercial advertising pressure.

Summary: This is a literature review and does not appear to have been peer reviewed or published in a journal.

"There has been little research into how and to what extent roadside advertising can cause driver distraction"

"The whole area is difficult to study due to differences in billboard types, drivers, roads, traffic etc"

"There is still a lack of comprehensive research evidence upon which to form guidelines or standards about how much distraction from outside of the vehicle is 'safe'"

Milloy, SL and Caird, JK. (2011). "External Driver Distractions: The Effects of Video Billboards and Wind Farms on Driver Performance." Published in: ***Handbook of Driving Simulation for Engineering, Medicine and Psychology.*** **Edited by: D.L. Fisher, M. Rizzo, J.K. Caird, & J.D. Lee. Boca Raton: CRC Press.**

Paper could not be sourced

Perez, WA., Bertola, MA, Kennedy, JF, & Molino, JA. (2012). "Driver Visual Behavior in the Presence of Commercial Electronic Variable Message Signs (CEVMS)." Unnumbered Report, Federal Highway Administration, Washington, DC.

Summary: This study used an instrumented vehicle with an eye tracking system to measure where drivers were looking when driving past digital and standard billboards. These billboards did not contain dynamic video or other dynamic elements, but changed content approximately every 8 to 10 seconds.

"In the present study, the presence of (digital billboards) did not appear to be related to a decrease in looking toward the road ahead."

"The results did not provide evidence indicating that (digital billboards), as deployed and tested in the two selected cities, were associated with unacceptably long glances away from the road"

"When comparing the probability of a gaze at a (digital billboard) versus a standard billboard, the drivers in this study were generally more likely to gaze at (digital billboards) than at standard billboards."

"The present data suggest that the drivers in this study directed the majority of their visual attention to areas of the roadway that were relevant to the task at hand (e.g., the driving task). Furthermore, it is possible, and likely, that in the time that the drivers looked away from the forward roadway, they may have elected to glance at other objects in the surrounding environment (in the absence of billboards) that were not relevant to the driving task. When billboards were present, the drivers in this study sometimes looked at them, but not such that overall attention to the forward roadway decreased"

Rempel, G, Montufar, J., Forbes, G. & Dewar, R. (2015). "Digital and Projected Advertising Displays: Regulatory and Road Safety Assessment Guidelines." Unnumbered Transportation Association of Canada Report.

This report is the Canadian Report discussed in the Statement of Evidence

Roberts, P., Boddington, K., & Rodwell, L. (2013). Impact of Roadside Advertising on Road Safety. Austroads Road Research Report: Publication No. AP-R420-13. City: Australia, ARRB Group.

Summary: This report is a review of other research.

"There is compelling evidence that distraction is a major contributor to crashes. However, studies providing direct evidence that roadside advertising plays a significant role in these distraction based crashes are currently not available. The studies that have been conducted show convincingly that roadside advertising is distracting and that it may lead to poorer vehicle control. However, the evidence is presently only suggestive of, although clearly consistent with, the notion that this in turn results in crashes.

It is also worth noting, on the basis of Klauer et al.'s (2006) results, that while looking at an external object increased the crash risk by nearly four times, less than 1% of all crashes and near crashes were from this source of distraction. A substantial proportion of these external objects would not have been advertising signs. Thus, while it is not possible to tell from the reported results, it is reasonable to conclude that far less than 1% of all crashes and near crashes involved distraction from roadside advertising.

While the Klauer et al. (2006) study may not be representative of all driving events, it does suggest that the contribution of roadside advertising to crashes is likely to be relatively minor"

Samsa, C., & Phillips, T. (2015). Digital Billboards 'Down Under'. Are they Distracting to Drivers and can Industry and Regulators Work Together for a Successful Road Safety Outcome? ***Paper Presented at the 4th International Conference on Driver Distraction and Inattention,*** **Sydney, Australia.**

Summary: A total of 29 participants drove an instrumented vehicle along a 14.6 km route in Brisbane, Queensland passing a number of advertising signs, including digital and static billboards and on-premise signage. Number of fixations and dwell times towards advertising signs were measured, along with lateral deviation and vehicle headway.

"The findings show that digital billboards do not draw drivers' attention away from the road for dangerously long periods of time compared to the other signage types, and drivers maintained a safe average vehicle headway in the presence of these signs"

Schieber, F., Limrick, K. McCall, R, & Beck, A. (2014). Evaluation of the Visual Demands of Digital Billboards Using a Hybrid Driving Simulator. *Proceedings of the Human Factors and Ergonomics Society 58th Annual Meeting,* 2214-2218.

Summary: The study used a specially-built simulator and a sample of 18 participants to assess driving performance in the presence of a simulated digital billboard at speeds of 40km/h and 80km/h. The participants were required to read aloud the message on the billboard which comprised of 4, 8 or 12 words selected at random, with the billboard simulating a 3.3m wide billboard.

"Video-based driving simulators are not well suited for studying a driver's ability to extract information from signs at the same distances at which drivers can perform such tasks in the real world. These simulators lack sufficient display resolution to render sign stimuli that are readable at a distance. In the study reported here, we designed, built and evaluated a specialized hybrid simulator."

"Little or no decrement in lane keeping or reading performance was observed at 40km/h on straight roads (but) performance was significantly degraded when participants were required to read digital billboards with 8 or more words at 80km/h."

Sisiopiku, VP, Islam, M, Haleem, K, Alluri, P. & Gan, A. (2014). Investigation of the Potential Relationship between Crash Occurrence and the Presence of Digital Advertising Billboards in Alabama and Florida. *Proceedings of the Transportation Research Board (TRB) 94th Annual Meeting.*

Summary: This is a poster presentation showing the crash rates upstream and downstream of digital billboards in two USA states. It is discussed further in the Statement of Evidence.

Young, MS, Mahfoud, JM, Stanton, N. Salmon, PM, Jenkins, DP & Walker, GH. (2009). "Conflicts of Interest: The implications of roadside advertising for driver attention." ***Transportation Research Part F: Traffic Psychology and Behaviour, Vol. 12*****(5), 381-388.**

Summary: The study used a sample of 48 drivers using a vehicle simulator to travel urban, rural and motorway journeys of 4.8 to 9.1km in length (6 runs per participant). After each run, participants were asked to recall the last road sign and, in the case of billboards, the last billboard which they saw. Metrics including time spent out of lane, number of lane excursions, and average and minimum distance to the vehicle ahead were measured.

"On the basis of research so far, whilst it is clear that roadside advertising has potential effects on driver distraction, it remains difficult to be conclusive about the specific risks. Results from early field studies as well as more recent controlled experiments seem to conflict with each other, whilst concern about the risks is based on estimates and self-report data".

"This study has found that roadside advertising can be detrimental to performance (in terms of lateral control) and pose a distraction for drivers (in terms of increased mental workload). This conclusion stands apart from previous field research, which has been inconclusive or has not found such an effect"

"Whilst the methodological particulars of such studies have already been discussed earlier in this paper, we must also consider the limitations of the laboratory method in interpreting the present results. For instance, the simulated image can never offer the resolution of the real world, and so there may have been some legibility issues with the billboards that could have affected viewing behaviour. Also, the instructions to recall road signs and/or billboards may have influenced performance on subsequent trials, and whilst there is always a trade-off between the benefits of naïve against informed participants in such circumstances, it is possible that this interfered with the attention data. Finally, the analysis of the eye-tracking data by sector was admittedly a coarse approach, an unfortunate consequence of the equipment used, and future studies would benefit from a more precise method of determining allocation of visual attention."