

# BEKON

## Proposed Digital Billboard Queen Street, Nelson

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### Assessment of Transportation Matters

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**CARRIAGEWAY**  
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## Annexure A: Review of Papers

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## 1. Introduction

- 1.1. Bekon Media Limited proposes to install a digital billboard on the northwestern corner of 322 Queen Street, Nelson. The angle of the billboard means that it will be visible to drivers travelling southbound on Lower Queen Street and to drivers travelling eastbound on Gladstone Road. It will not be visible to drivers approaching on the other two legs of the intersection.

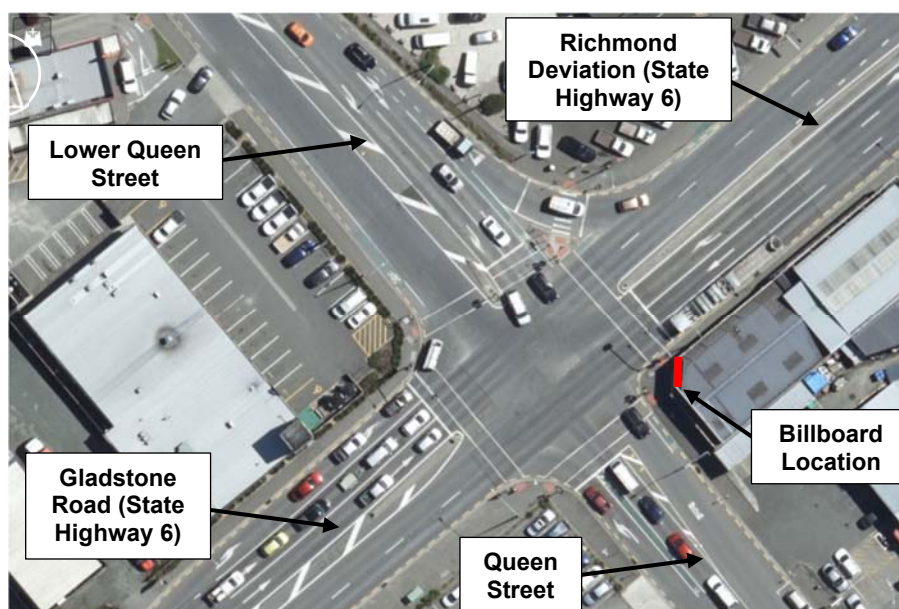


Figure 1: Location of Proposed Billboard

- 1.2. It is understood that the digital billboard will be mounted on the roof of the building, above the west-facing angled wall. The billboard itself will be 7m wide and 3.5m high and will be in 'landscape' orientation. The position means that the bottom of the billboard will be 5.3m above ground level.



Figure 2: Visual Mock-Up of Proposed Billboard Location (Extract from DCM Urban Drawing)

- 1.3. This report considers the transportation aspects of the proposed digital billboard, including the potential effects on road safety.

## 2. Current Transportation Environment

### 2.1. Roading Layout

- 2.1.1. Gladstone Road forms part of State Highway 6. On the approach to the billboard location the highway cross-section is influenced by the presence of intersections. Typically, it provides two lanes in each direction, separated by a flush median, and 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.



Photograph 1: Gladstone Road Looking East (Billboard Location in Distant Background)

- 2.1.2. Approximately 70m west of the proposed billboard location, 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. Thus there are three traffic lanes on the immediate approach to the intersection.



Photograph 2: Gladstone Road Approach to Intersection with Lower Queen Street

- 2.1.3. The Gladstone Road / Lower Queen Street intersection is signalised, with five signal heads facing eastbound traffic (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 pedestrians crossing phases on each approach (although the carriageway markings for the crossing are heavily worn in places).
- 2.1.4. There are footpaths on each side of the highway, and there are multiple driveways on either side which serve the well-established commercial activity that fronts the highway. However there are no cycling facilities.
- 2.1.5. Lower Queen Street is subject to a 50km/h 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 'bypass' lane which is not signalised.



**Photograph 3: Lower Queen Street Approach to Intersection with Gladstone Road**

- 2.1.6. 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.
- 2.1.7. The left-turn lane is not signalised, and operates under give-way control although we note that 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 we 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 separated the left-turn lane from the 'straight ahead' lane.
- 2.1.8. There are footpaths on either side of Lower Queen Street. There are also on-road cycling facilities, with a northbound cycle lane and green surfacing provided, plus a corresponding southbound lane. 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).



2.1.9. Lower Queen Street has one private accesses in the immediate vicinity of the Gladstone Road / Lower Queen Street intersection, which is an access serving a McDonald's restaurant and drive-thru lane.

## **2.2. Traffic Flows**

2.2.1. Waka Kotahi carries out regular traffic surveys on the state highway network. The closest counter location lies 1.3km to the west of the site (id: 00600130) but as there are a number of side roads between this location and the site, the traffic volumes recorded can only be considered indicative. In 2023, this location showed the highway carried an Annual Average Daily Traffic of 21,050 vehicles (two-way), and as noted above, half of these vehicles would have views of the proposed billboard.

2.2.2. According to the MobileRoad website, Lower Queen Street north of Gladstone Street carries 9,660 vehicles per day (two-way), suggesting 4,830 vehicles per day will travel southbound and vehicle occupants will be able to see the billboard.

## **2.3. Road Safety**

2.3.1. The Waka Kotahi CAS database has been used to review the reported crashes over a distance of 100m west and north of the proposed billboard location<sup>1</sup> involving eastbound and southbound traffic<sup>2</sup>. Over the past five years (2019 to 2023), plus the partial record for 2024, there were 21 crashes reported in this area from where drivers could potentially have seen the billboard (if it was in place):

- 4 crashes were associated with the left-turn lane from Lower Queen Street into Richmond Deviation
  - One crash occurred when a driver attempted to turn into the unsignalised left-turn lane on Lower Queen Street and collided with a vehicle waiting in the adjacent southbound traffic lane. The crash did not result in any injuries;
  - One crash occurred when a driver turned out of the unsignalised left-turn lane on Lower Queen Street and was struck by an eastbound vehicle on Gladstone Street. The crash did not result in any injuries.
  - One crash occurred when a driver turned out of the unsignalised left-turn lane on Lower Queen Street and struck a vehicle ahead. The crash did not result in any injuries.
  - One crash occurred when a driver turning left out of the unsignalised left-turn lane on Lower Queen Street was struck by a following vehicle. The crash did not result in any injuries.
- 3 crashes were associated with drivers disobeying the signage and attempting to turn right in locations where there is a prohibition on this movement:
  - 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.
  - 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.

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<sup>1</sup> On the basis that the billboard is expected to be seen over a distance of 80m, as discussed subsequently, plus a margin of error for any miscodes of the crash locations.

<sup>2</sup> Since the billboard will not be able to be seen by westbound and northbound drivers



- 3 crashes occurred on the Gladstone Road approach
  - 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.
  - 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
- 3 crashes occurred on the Lower Queen Street approach
  - One crash occurred when a southbound driver on Lower Queen Street was struck by a following vehicle. The crash did not result in any injuries.
  - One crash occurred when a car going straight ahead into Queen Street failed to stay in their own lane, and struck a truck that was turning right onto Gladstone Road. The crash did not result in any injuries
  - One crash occurred when a car reversed at speed into a car waiting behind. The crash did not result in any injuries
- 4 crashes involved drivers failing to stop at red traffic signals
  - One crash occurred when an eastbound vehicle on Gladstone Street 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.
  - One crash occurred when a westbound vehicle on Richmond Deviation failed to stop for a red signal and struck by a southbound vehicle on Lower Queen Street. The crash resulted in minor injuries.
  - One crash occurred when a westbound vehicle on Richmond Deviation failed to stop for a red signal and struck by a northbound vehicle on Queen Street. The crash did not result in any injuries.
  - One crash occurred when an eastbound vehicle on Gladstone Street 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.
- 3 crashes occurred due to turning movements from Lower Queen Street:
  - 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.
  - 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.
- There was one other crash recorded:
  - One crash occurred when a pedestrian crossed Richmond Deviation from north to south against the traffic signals, and was struck by a westbound vehicle. The crash resulted in serious injuries.

2.3.2. 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 urban intersections. As such, it does not appear that there are any inherent road safety deficiencies at this location. However the crashes are discussed further below.

## **2.4. Existing Signage in the Area**

2.4.1. Based on site visits, there are only a small number of existing statutory road signs within 100m of the billboard in locations from where the images displayed can be seen/read at the same time as the proposed static billboard:

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



- 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;
- RG-17 'keep left' single disc signs on the ends of the raised islands on Gladstone Road and Lower Queen Street;
- 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';
- PW-30 ' pedestrian crossing' sign on Lower Queen Street (approximately 95m from the proposed billboard location);
- Belisha beacon discs at the zebra crossing in the left-turn lane.

2.4.2. These static signs are in addition to the traffic signals at the intersection.

2.4.3. There is also a considerable number of roadside advertising signs on this section of the roading network, defined by the Waka Kotahi Traffic Control Devices Manual Part 3 ('Advertising Signs') 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):

- Signfaces on the properties fronting the road due to the commercial nature of the land use zoning; and
- Plinth-type sign with shop names on the southern and western sides of the intersection.



**Photograph 4: Examples of Other Signage Near the Billboard Location (Looking East)**



### 3. Overview of Road Safety Implications of Billboards

#### 3.1. Waka Kotahi Traffic Control Devices Manual (Part 3) Advertising Signs

- 3.1.1. The Waka Kotahi Traffic Control Devices Manual addresses various aspects of roadside advertising signs (which as set out above means signs, including those that are within private property that are intended to be seen by road users) and it includes billboards. Importantly, the manual sets out that each particular installation should be treated on its own merits having regard to its purpose, nature and location, and with an expectation that sound judgement is used to ensure they are effective but without compromising safety. It also notes that there is no reason why an off-site advertising sign should have more of an adverse effect than a similar on-site sign, provided that suitable controls are in place to avoid signage proliferation.
- 3.1.2. Under this document, at a general level, any advertising sign should not:
- contain reflective material if it is likely to reflect the light from the lamps of any vehicle on the road, or fluorescent or phosphorescent material if it is likely to mislead or distract drivers from traffic signs installed in the vicinity, or mask those signs;
  - be capable of being mistaken for a traffic control device, including use of red, green, orange, white or yellow in combinations of colours, or shapes which may be mistaken for a traffic control device;
  - use red, green, orange, white or yellow colours in a location where it is likely to form the foreground or background to or appear alongside a traffic control device of similar colour when viewed by approaching motorists;
  - contain large areas of red, green or orange displayed on illuminated signs which at night are likely to cause confusion with traffic control signals or tail lights of vehicles;
  - give instructions to motorists that could conflict with any traffic sign or traffic control device; or
  - compete with existing direction signs.
- 3.1.3. There are controls on the brightness of illuminated signs, and for a sign with more than 10sqm of illuminated area within an area with street lights, such as is the case in this instance, a maximum 800cd/sqm is permitted.
- 3.1.4. To help avoid safety issues, the Manual sets out that advertising signs on urban roads (defined as where a speed limit is less than 70km/h) should not be located within 100m of intersections and permanent regulatory or warning signs, although it also sets out that there are many advertisements close to intersections or traffic control devices that apparently cause no problems.
- 3.1.5. The recommended visibility for signs relates to the vehicle speeds, with signs on roads with higher speeds needing to be visible from a greater distance, and within a narrowed angle of view for the driver. Figure 5.1 of the manual shows that at where there is a speed limit of 50km/h, a 45 degree angle of vision is appropriate on either side of the road, and an additional 15 degrees can be added to allow for the driver moving their head. Minimum (unrestricted) forward sight distances of 80m are also appropriate for a posted 50km/h speed limit and adjacent roadside advertising signs are recommended to be at least 50m apart.
- 3.1.6. Specific care is also required when considering animated, flashing and variable message signs for advertising, with regard to location and visibility distraction to motorists. Animation and flashing signs should not be used where the speed of passing traffic is more than 70km/h, and variable message signs require “*careful assessment*” where sited close to an intersection or



where vehicles merge/diverge. Notably, the manual sets out that such signs should have static displays, change display over a timeframe of less than two seconds, and have a minimum time for separate displays of more than five seconds.

### 3.2. General Assessment of Road Safety Effects of Billboards

#### Research Papers

3.2.1. There are a variety of reports which address the road safety effects of digital billboards. One is a 2013 research report produced by the Austroads organisation<sup>3</sup>. 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). As set out below, animation, driver interaction and large-scale projections are not proposed by this application.

3.2.2. The report adopts a cautious approach in drawing any conclusions noting that:

*“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.**”<sup>4</sup> (**Emphases added**)*

3.2.3. Another report is that of Horberry et al from 2009<sup>5</sup>, 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*

<sup>3</sup> Austroads Research Report AP-R420-13, “Impact of Roadside Advertising on Road Safety” Section 3)

<sup>4</sup> Austroads Research Report AP-R420-13, “Impact of Roadside Advertising on Road Safety” Section 5.2

<sup>5</sup> 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>



information (e.g. billboards and other 3rd party advertising) in the road environment cannot be fully evidence-based.”<sup>6</sup>

- 3.2.4. This indicates that the paper is therefore highlighting 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. It is important to note that this paper was produced nearly 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).
- 3.2.5. Subsequent to the Horberry paper, 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<sup>7 8 9 10</sup>.
- 3.2.6. The Canadian Digital and Projected Advertising Displays: Regulatory and Road Safety Assessment Guidelines (TAC 2015) concludes that “*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*” (Section 2.1.4 of that Guide). 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. Allowing for suitable conditions of consent regarding the images displayed, this will be achieved in this instance.
- 3.2.7. Finally, a review of primary research was 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 papers and a review of most of the papers themselves (several could not be located) is set out in Annexure A.
- 3.2.8. In brief, it is not apparent that there are compelling supporting arguments for the link between road safety and digital billboards. 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. The authors of other studies specifically limit their research in some way, such as due to the uniqueness of the roads assessed, the small data set examined, or being careful to draw a distinction between billboards attracting attention versus creating distraction. In other cases, it is evident that the prevailing environment assessed is different to that which is present for the current application.
- 3.2.9. Importantly, in many cases, the research is not clear whether the digital billboard included moving images or was solely static. It is unclear then how many of the papers are directly applicable to the current application and therefore whether they can be given any weight in this specific context.

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<sup>6</sup> Ibid, page 6

<sup>7</sup> Driver Visual Behavior In The Presence of Commercial Electronic Variable Message Signs (CEVMS), FHWA, 2011

<sup>8</sup> 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

<sup>9</sup> Young, KL et al (2017). Investigating the Impact of Static Roadside Advertising on Drivers’ Situation Awareness, Applied Ergonomics, Vol 60, 136-145

<sup>10</sup> 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.



- 3.2.10. By way of example, one study often cited is that of Sisiopiku, VP, Islam, M, Haleem, K, Alluri, P. & Gan, A. (2014)<sup>11</sup>. 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).
- 3.2.11. 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.
- 3.2.12. Finally, one other paper attempted to control for any effects arising from driver under-reporting of crashes involving distraction due to digital billboards<sup>12</sup>. 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 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.
- 3.2.13. The authors concluded that *“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”*<sup>13</sup>.
- 3.2.14. Taken overall, the research does not demonstrate a clear link between the presence of digital billboards and a rise in the number of crashes recorded.

#### Road Safety Records

- 3.2.15. In evaluating the potential of digital billboards to result in adverse road safety effects, there is some research within New Zealand that reviews the incidence of reported crashes in the vicinity of such billboards. This study took the form of reviewing the crash rates at locations before and after a digital billboard was installed, and comparing the two to see whether there had been any significant change. This study showed no clear evidence of a systematic increase in crash rates due to digital billboards.
- 3.2.16. At a more general level, there are now well over 500 digital billboards operating within New Zealand. This not only means that they 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 a large amount of data relating to crash numbers and patterns in the vicinity of the billboards.

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<sup>11</sup> 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) 94<sup>th</sup> Annual Meeting*.

<sup>12</sup> 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.

<sup>13</sup> Ibid, page 11



- 3.2.17. As at October 2022, there were 486 large-format digital signs in New Zealand<sup>3</sup>, plus a further 250 or so smaller screens in bus shelters. There are also numerous digital displays within shop windows which are orientated towards approaching traffic (in passing, many of these use animation). The first large-format digital billboard was erected in 2012. Adopting a conservative approach of each location having only 10,000 views per day (and most sites have considerably more than this), 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, it can be estimate that there have been at least 5.5 **billion** views of digital billboards by drivers.
- 3.2.18. Despite this, a review of the Waka Kotahi CAS database shows there has been no reported crash where distraction from a consented digital billboard has been cited as a contributing factor, and 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.

### 3.3. Conclusions

- 3.3.1. Based on this review, the available literature is sometimes contradictory. However, it appears possible that digital billboards attract driver attention to a greater extent than static billboards, although this conclusion must be interpreted cautiously as in most 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 extensive animation). 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, *if* digital billboards attract more driver attention then this is not to the extent that a road safety problem arises.
- 3.3.2. An examination of the crash records in New Zealand in the vicinity of digital billboards does not show that rates increase once a digital billboard is installed. This is despite a conservative calculation of more than five billion views of digital billboards by drivers in New Zealand.
- 3.3.3. 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 studies show can have an adverse effect on road safety (for example, animation) are addressed through conditions of consent to eliminate (or substantially mitigate) this characteristic.



## 4. Compliance with Waka Kotahi Recommendations

### 4.1. *Billboard Location*

- 4.1.1. The 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.
- 4.1.2. Queen Street in this location is subject to a 50km/h speed limit and therefore is classified as a 'urban' road under the recommendations because of the speed limit. As such, there is a recommendation to have a 100m separation between any permanent regulatory/warning signs and any intersections. The rationale for this distance is that a billboard may obscure the traffic sign or otherwise detract from the effectiveness of the traffic sign.
- 4.1.3. This distance is not achieved as there are a number of road signs as discussed above. However as the 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 billboard and because of this, the signs will appear more visually prominent than the billboard. By way of example, as a driver approaches the intersection from Gladstone Road, the 'no right' turn signs will be closer to them than the billboard, meaning at (say) 50m, perspective means that the road signs will appear to be one third the height of the billboard.
- 4.1.4. Further, there are numerous locations within New Zealand where digital billboards are within 100m of an intersection or other signage and where no adverse safety effects have arisen.
- 4.1.5. For a 50km/h prevailing speed limit, the billboard needs to be visible for at least 80m on the immediate approaches. This is achieved.
- 4.1.6. There is also a recommendation that billboards should be placed as close as possible to drivers' lines of sight. It is evident from Figures 1 and 2 above that approaching drivers need to turn their head very little to see the billboard.
- 4.1.7. Additionally, under the Manual, roadside advertising signs are recommended to be a minimum of 50m apart although it is recognised that this may not be achievable in many circumstances. In this instance, there are numerous existing advertising signs on this part of the roading network and so the separation distance is already not achieved. Rather, drivers will be well-used to seeing roading advertising signage in the area.

### 4.2. *Signface*

- 4.2.1. Controls (through conditions of consent) are proposed to be put in place to ensure that the images displayed on the billboard 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 lighting of the sign can also be suitably controlled.
- 4.2.2. With regard to the images displayed, the Traffic Control Devices Manual sets out the minimum sizes for lettering to enable it to be seen by drivers. However the vast majority of images on (any) billboard include graphics, text that is expected to be read, and text that is not expected to be read. The latter is typically required for legal reasons and is usually displayed at a very small size that makes it, in effect, illegible to passing drivers.



- 4.2.3. By way of example, a home loan advertisement is likely to have the bank logo and corporate colours, the interest rate in larger letters, and the terms and conditions under which the loan is offered in small print. The intent is that the viewer sees the bank name and rate, but does not attempt to review the terms and conditions.



**Photograph 5: Example of Advertising Showing Legal 'Small Print' (Bottom of Image)**

- 4.2.4. The same applies to the types of font used. Many fonts that are used for the name of companies are difficult to read in and of themselves (such as Coca Cola, Starbucks, and Johnson & Johnson). However, viewers do not read the wording as such, but rather, recognise the image that is created by the combination of the font and the words.
- 4.2.5. Research shows that in complex driving situations, drivers reduce the time that they spend on non-essential driving tasks (such as glancing at billboards). However, even disregarding this, the average glance time at a billboard is less than a second<sup>14</sup>. This is not sufficient for a driver to read each individual word on a displayed image, but rather, just to see and assimilate the overall image and/or core information. Put another way, information that cannot easily be read is simply ignored.
- 4.2.6. Taking this into account, it is not considered that there is any need to specify fonts or font sizes for the image shown on the billboard.
- 4.2.7. With regard to the use of animation, as set out above minor changes in the displayed images are unlikely to have adverse road safety effects. The research in this area is limited however, and therefore it is considered that any animation should be used cautiously. Given the difficulties in defining what constitutes 'light' or 'minor' animation, it is more straightforward to simply prohibit animation, as is proposed.

### **4.3. Summary of Compliance**

- 4.3.1. Overall, it is considered that the billboard complies (or is able to comply) with the majority of the Waka Kotahi recommendations, with suitable conditions of consent to be put in place to provide certainty in respect of colour of displays, animation, display time, and time of transition to the next image.
- 4.3.2. The exception to compliance relates to the separation of the billboards from a nearby intersections and permanent regulatory / warning signs. These are assessed in detail below,

<sup>14</sup> 3 Samsa, C. (2015) "Digital billboards 'down under': are they distracting to drivers and can industry and regulators work together for a successful road safety outcome?" Proceedings of the 2015 Australasian Road Safety Conference 14 – 16 October, Gold Coast, Australia





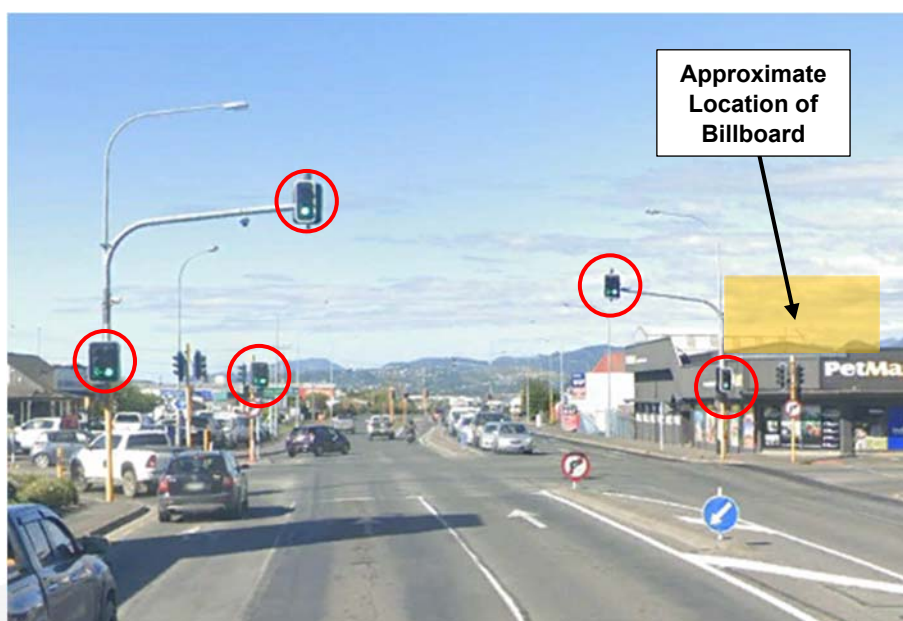
but in summary, it is not considered that the proposed billboard will result in adverse transportation effects arising in these regards.



## 5. Further Analysis of Road Safety Issues

### 5.1. Potential for Overlap with Traffic Signals

- 5.1.1. As noted previously, the proposed location of the billboard is adjacent to a signalised intersection. There is no evidence that billboards in the vicinity of traffic signals present any adverse road safety effects, and in this case, the billboard is elevated above the level of the surrounding roadways. However a specific assessment of the potential effects has been carried out.
- 5.1.2. 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 billboard for approaching drivers, plus the billboard is elevated above three of the five traffic signals.



**Photograph 6: Traffic Signal Locations on Gladstone Road in Relation to Billboard Location**

- 5.1.3. The Approach Sight Distance (**ASD**) is defined as being the distance required for a driver to see and react to a hazard ahead and stop their vehicle before a collision occurs. Thus this represents the latest point at which any overlap with any signage is relevant, as beyond this point, the driver has insufficient distance to stop their vehicle regardless. For a prevailing speed limit of 50km/h (and an operating speed of 55km/h), the ASD is 63m.
- 5.1.4. At 63m from the stop-line of the traffic signals, the proposed billboard would be more than 90m from the approaching driver. However, as set out above, any roadside advertising is only expected to be visible at 80m, making it very unlikely that at the last point where a driver decides whether to stop or not they will be looking at the billboard.

5.1.5. Nevertheless, an assessment of potential for visual overlap has been carried out. The process for doing this has been:

- The billboard and traffic signals are positioned onto an aerial photograph
- Lines of sight are added, from the edges of the billboard, running through the position of the signals and beyond to the approaching traffic lanes.
- The area between these lines therefore represents the area where a driver might see the billboard appearing in the background of the sign.

5.1.6. This is shown below.



**Figure 3: Potential For Overlapping with Signage in the Horizontal Plane**

5.1.7. It can be seen that in the horizontal plane, there is the potential for overlap with the primary signal head, but not the dual primary, secondary or tertiary signal heads.

5.1.8. On this basis, the vertical plane has been considered. As noted above, the bottom of the billboard is located at 5.3m above ground level and since it is 3.5m in height, this means that the top of the billboard is at 8.8m above ground level. A driver's eye height is 1.1m above ground level, and the primary traffic signals are 4m above ground level and located 23m from the billboard.

5.1.9. By a process of trigonometry and similar triangles, it can be calculated that there will be visual overlap between the traffic signal and the billboard between 38m and 138m from the billboard (11m to 111m from the stop-line of the traffic signals). This therefore confirms that there will be visual overlap at the locations where drivers take the decision about whether to stop at the signals or not.

5.1.10. It is considered that there are a number of additional factors that are relevant in this case. Firstly, in practice, drivers do not receive information about whether to stop at traffic signal from just one traffic signal, but from all signals plus the actions of drivers ahead of them (by way of example a driver stops if the car ahead stops). In this case, there is a dual primary traffic signals provided where there is no overlap present, as well as two other traffic signals on the southern side of the intersection.

5.1.11. There is also a parallax effect which arises, because as a driver approaches the intersection, the separation between the primary traffic signal and the billboard means that the traffic signal will appear to move from right to left across the billboard. This makes it evident to a driver that

the traffic signal head is a different object to the billboard, and thus less likely that the driver will confuse the two.



**Figure 4: Sightlines Showing the Primary Signal Appears to Move Relative to the Billboard as a Driver Approaches**

5.1.12. Finally, as is the case for most traffic signals, the lanterns are surrounded by a black target board. This provides a clear visual differentiation between the lanterns of the traffic signals and the billboard behind, again making it straightforward for a driver to comprehend that the two are separate objects and thus minimise any potential that the driver confuses the two.

5.1.13. The situation of traffic signals overlapping a billboard is not uncommon in New Zealand, and there are a number of other locations where this occurs. However in none of these locations has there been any evidence of an increase in crashes.



**Photograph 7: Traffic Signal Overlap, State Highway 1, Timaru, Showing Visual Separation Created by Target Board**

## 5.2. General Proximity of Traffic Signals and Billboard

- 5.2.1. A considerable number of consents have been granted where traffic signals are in close proximity to digital billboards. An evaluation has been undertaken of other known locations where digital billboards are provided, where the billboard has been established for some considerable time.
- 5.2.2. As an example, one such location is at the George Bolt Memorial Drive / Tom Pearce Drive intersection near Auckland Airport. At this location, the digital billboard forms the background to the traffic signal heads. As the primary access to the airport, George Bolt Memorial Drive in this location carries around 40,000 vehicles per day (two-way) meaning that at least 20,000 southbound drivers will have sight of the digital billboard each day, which is greater than would see the proposed billboard at Queen Street. However no crashes have been recorded at this location due to drivers being distracted by advertising signs over the past ten years.



Figure 5: Digital Billboard at the George Bolt Memorial Drive / Tom Pearce Drive Intersection

- 5.2.3. An assessment of 'before and after' crash rates at digital billboard locations does not reveal any evidence of any increase in crashes after digital billboards are installed.
- 5.2.4. Accordingly, it is not considered that there is any reason to anticipate that the installation of the digital billboard will result in driver confusion or any adverse safety-related effects.

## 5.3. Assessment of Reported Crashes

- 5.3.1. The crashes recorded at this intersection have been reviewed in more detail.
- For the 4 crashes were associated with the left-turn lane from Lower Queen Street into Richmond Deviation, the proposed static billboard would be outside the field of vision of the turning driver;
  - For the 3 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 instructing drivers of the prohibited movement. These are more signs directly in front of the driver than the static billboard would be, plus as noted above, from the drivers' perspective the signage would appear relatively large compared to the billboard. 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 billboard.

- The 3 nose-to-tail crashes that occurred on the Gladstone Road and Lower Queen Street approaches occurred some distance from the billboard, and this type of crash is common in urban areas;
- Crashes involving drivers failing to stop at red traffic signals is not uncommon at urban intersections, and only one (in five years) occurred in locations where drivers could have seen the proposed billboard. The other 3 occurrences of this type of crash occurred involved an at-fault driver that could not have seen the billboard;
- One of the 3 crashes that occurred due to turning movements from Lower Queen Street occurred 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 2 crashes involving turning movements from Lower Queen Street, the movement means that the billboard would move outside the drivers' field of vision prior to the collision.
- The crash that occurred when a pedestrian crossed Richmond Deviation from north to south against the traffic signals, and was struck by a westbound vehicle, involved a driver that could not have seen the billboard. There is no evidence that the pedestrian was in any way distracted, rather, they were simply crossing heedless of traffic.

5.3.2. Of the three remaining crashes not discussed above, the crash involving a driver clipping a trailer 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. There is no data regarding the reasons 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. There is also no reason why a driver reversed into the vehicle behind.

5.3.3. On the basis of this review, and taking all relevant matters into account, it is not considered that the nature or frequency of reported crashes would be likely to be influenced by the presence of the billboard.





## 6. Proposed Conditions of Consent

6.1. Although a number of digital billboards have been consented around the country, all have associated conditions of consent in respect of their operation. In each case, these are required to ensure compliance with the Waka Kotahi Traffic Control Devices Manual, and/or supported by research regarding the safe operation of digital billboards, and so it is expected that they will be offered as part of this application also:

- Each image displayed shall be static, and not contain or emit flashing lights, movement, animation, or other dynamic effect.
- The images displayed shall not incorporate the predominant use of graphics, colours or shapes that could cause confusion or conflict with any traffic control device, nor invite or direct a driver to undertake an action.
- The display time for each image shall be a minimum of 8 seconds.
- The transition from one image to the next shall be via a 0.5 second dissolve.
- A split sign (that is two adverts) shall not be displayed at any one time.
- Images on the billboard shall not be linked to “tell a story” across two or more sequential images (that is, where the meaning of an image is dependent upon or encourages viewing of the immediately following image).
- The consent holder shall ensure that in the event of any malfunction of the LED’s or the control system, the screen default shall be designed to freeze a display in one still position or default to a black screen until the malfunction has been repaired.

6.2. It is also considered that two Advice Notes should be included:

- Reflective materials are not to be used for the digital display units, and would potentially be contrary to relevant legislation.
- The legal framework relating to digital billboards is set out in Clauses 3.1 and 3.2 of the Waka Kotahi Traffic Control Devices Manual Part 3 (‘Advertising Signs’) 2011.

6.3. Based on the available research, these provisions will ensure that the signface and the operation of the billboard meet best practice and do not result in driver confusion or distraction.



## 7. Conclusions

- 7.1. This report has identified, evaluated and assessed the various transport and safety elements of a proposed digital billboard at Queen Street, Nelson. Based on the analysis, it is considered that the digital billboard will not present any particular road safety concerns provided that suitable controls (through conditions of consent) are put in place.
- 7.2. The location of the billboard meets the recommendations of the Waka Kotahi Traffic Control Devices Manual (Part 3, Advertising Signs), other than in respect of the proximity to intersections, and to permanent warning / regulatory signs. These matters have been specifically evaluated and it is considered very unlikely that adverse safety-related effects would arise (again, subject to suitable conditions of consent being put in place).
- 7.3. The matter of the overlap of one traffic signal has also been evaluated in detail, and it is considered that no adverse effects would arise from this.
- 7.4. Overall, and subject to the preceding comments, the proposed digital billboard can be supported from a traffic and transportation perspective and it is considered that there are no traffic and transportation reasons why consent could not be granted.

Carriageway Consulting Limited  
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**CARRIAGEWAY**  
**CONSULTING**

traffic engineering | transport planning

A. PO Box 29623, Christchurch, 8540 P. 03 377 7010 E. [office@carriageway.co.nz](mailto:office@carriageway.co.nz)