MEMORANDUM

HARRIES
TRANSPORTATION ENGINEERS LTD.

To:	Anthony Blomfield – Bentley & Co. Ltd	**From:**	Brett Harries
cc:		**HTE File:**	cen02
cc:		**Date:**	28 May 2025

Re: Jaafar Holdings Ltd – 44 Mt Wellington Highway
Variation to Conditions 1 and 10 of Resource Consent LUC60326896
Response to Further Information Request - Traffic

1 Introduction

This memorandum responds to a Further Information Request ("RFI") received from Auckland Council by way of a letter dated 24 April 2025 in relation to a proposal by Jaafar Holdings Limited to vary conditions 1 and 10 of resource consent LUC60326896. Specifically, the proposal seeks to vary the image dwell time from 30-seconds to 8-seconds that applies to the existing north-facing screen of a double-sided V-oriented digital billboard pair that is located near to the northwestern corner of the site at 440 Mount Wellington Highway ("MWH") in Mount Wellington ("Site").

The RFI contains four queries re traffic matters. These are responded to separately in the following sections. The responses provided should be read alongside the Traffic Engineering Report ("TER") "*Proposed Consent Variation - Digital Billboard Dwell Time – 440 Mt Wellington Highway, Mt Wellington*" prepared by Harries Transportation Engineers and dated 17 March 2025, that accompanied the application.

2 Query 1 – Traffic exposures to image changes

"Please provide a detailed assessment of the number of image changes a westbound driver is likely to be exposed to while travelling through the Mt Wellington Highway interchange, from the point the billboard first becomes visible (even if only partially). The assessment should include:

a) A comparison between the existing 30-second dwell time and the proposed 8-second dwell time, including the number of image changes experienced by a driver under each scenario.

b) Consideration must be given to how exposure varies under different traffic conditions, including:

- *Free-flowing vs congested traffic - In free-flowing conditions, drivers may see fewer images depending on their travel speed and how long the billboard remains visible. In contrast, during congested conditions or stop-start traffic, drivers may be exposed to multiple image changes while remaining in the billboard's view for a longer duration. Please quantify the difference in exposure under both conditions.*

- *Peak vs off-peak periods - Traffic patterns and congestion levels vary throughout the day. The analysis should consider how exposure changes during peak periods (e.g., morning and evening peaks) versus off-peak times, particularly in relation to dwell time and queuing patterns through the interchange.*
- *Traffic signal phases (green vs red) - The experience of drivers will differ depending on whether they approach the billboard under a green signal (passing through continuously) or a red signal (waiting at the stop line). Please assess how the number of image changes viewed by a driver changes under each of these scenarios, and the potential implications for driver attention and distraction.*

c) *Outline how the operation of the traffic signals influences billboard visibility and image exposure.*

d) *Specific analysis of the number of image changes occurring while the billboard overlaps visually with the traffic signal head. This should consider all the traffic conditions as outlined under b. above."*

The available advance visibilities to the subject billboard from the points of initial (partial) visibility and then the full extent of screen visibility, are detailed for each approach lane in Table 1 on Page 8 of the TER.

In providing an analysis of the requested number of image changes that will be visible to motorists while within the visibility distances, it is necessary to consider travel speeds, (which is presumably the intent of the approach speed scenarios provided in the three bullet points listed in part b) of the query).

When considering the impact of the signal operations on approach speeds, it might be a somewhat obvious point to state that while a red signal is being displayed, vehicles will be either stationary, or moving only slowly in a queue of slow-moving vehicles. It is noted in this regard that the extent that motorists are able to observe an image change while either stationary or in a slow-moving queue is largely irrelevant to road safety on the basis that no harm is likely to come to a motorist if that motorist is in either a stationary, or moving only slowly in a slow-moving traffic queue, with the worst that is likely being a minor fender-bender. Even then, it is noteworthy that in the entire history of digital billboard operations in New Zealand, there is no known evidence to indicate that any rear-end crashes have occurred due to the driver being distracted by a billboard, regardless of travel speed.

Accordingly, in order to respond to the query, a range of approach speeds have been investigated that address the scenarios described in part b) of the query, being:

(a) The speed as recorded in the southbound direction as described in Section 2.1.2 of the TER, and which shows a 7-day 85th percentile speed[1] of 54km/h.

(b) The mean (i.e. average) travel speed, which was recorded in the speed surveys to be 47.6km/h.

(c) A maximum 'safe' travel speed of 30km/h, which is considered to represent the speed that might be typically experienced during congested conditions or in response to receiving a red signal. Speeds below 30km/h are considered, for the purposes of

[1] The 85th percentile speed is the speed that is exceeded by only 15% of vehicles, and which represents largely free-flow traffic conditions. The 85th percentile speed is most commonly used for design purposes in New Zealand

this analysis, to represent 'safe' travelling speeds that would very unlikely result in an adverse road safety effect even if an event did occur.

Table 1 below summarises, for each of the initial partial- and full-visibilities that will be available from each approach lane, the maximum number of transitions that would be experienced when travelling at the three travel speeds referred to above.

	Lane 1 (thru)		Lane 2 (thru / right)		Lane 3 (right)	
	Initial vis 137m	Full vis 103m	Initial vis 168m	Full vis 116m	Initial vis 213m	Full vis 141m
85th Percentile Speed 54km/h – Maximum No. of Transitions						
30 sec dwell time	1	1	1	1	1	1
8 sec. dwell time	2	1	2	1	2	2
Mean Speed 47.6km/h - Maximum No. of Transitions						
30 sec dwell time	1	1	1	1	1	1
8 sec. dwell time	2	1	2	2	3	2
'Safe' speed 30km/h - Maximum No. of Transitions						
30 sec dwell time	1	1	1	1	1	1
8 sec. dwell time	3	2	3	2	4	3

Table 1: maximum number of visible transitions for 8-second and 30-second dwell times based on the lane approach and whether partial or full visibility is available

As apparent from the above table, for most drivers the proposed dwell time variation will increase the maximum number of exposures to an image transition from one as currently occurs, to two. When traveling at a slow speed (30km/h), the 8-second dwell time may mean an exposure to three transitions, or in the case of the right turn Lane 3 when assessed from the point of initial partial legibility, four transitions.

It is noted however, that the practical legibility distance for image content on the subject billboard is between 80m and 120m, depending on the nature of the image being displayed. Beyond that legibility range, motorists will have no practical interest in looking at the billboard, simply because it will not be possible for image content to be 'read'. For the upper bound distance of 120m in the range of maximum legible distances, for all approach lanes the maximum number of exposures to an image transition will increase from one as currently occurs, to two.

It is also noted in this regard that neither the AUP nor the TCDM3 provide any standards or recommendations regarding the number of image transitions that motorists should be potentially exposed to. The operational characteristic that determines the number of transition exposures is dwell time. The AUP does not specify a minimum dwell time, and the TCDM3 recommends a minimum dwell time of 5-seconds which is achieved by the 8-seconds dwell time as proposed.

The only known potentially relevant publication that suggests longer dwell times is an early 2013 ARRB document "*Impact of Roadside Advertising on Road Safety*", AP-R420-13. This document attempted to bring together a common set of recommended operational criteria based on standards and guidelines that various roading authorities in Australia were

applying at that time, (i.e. it is not based on any empirical research). Within that document is a recommendation that the number of drivers who see an image change should be minimised, however this comes from another of their recommendations that the transitions between images should be instantaneous. That thinking no longer applies (certainly in New Zealand), because of the fact that an instantaneous transition can create a visual 'flick', and that this flick effect may potentially attract the involuntary attention of a driver. This possibility has been removed in New Zealand by the adoption of the much more subtle 0.5-second cross dissolve transition between images, as is already applied for the subject billboard.

It is also perhaps of some interest that the lead ARRB researcher who recommended in the 2013 document that drivers should not see more than one image change, was later a co-researcher in ARRB's 2018 empirical research regarding dwell times wherein it was found that there is in fact no road safety advantage to having longer dwell times.[2] This ARRB 2018 research is the only known empirical research that has assessed the safety related performances of a range of dwell times applied to digital billboards adjacent to complex signalised intersections. Relevantly to this application, the range examined was between 8-seconds and 30-seconds. The concluding paragraphs from the ARRB study are as follows:

> *"Furthermore, the 'positive' impact of digital billboards in the current evaluation did not occur exclusively with respect to lateral control. This effect was also observed (with one exception) for stopping over the line violations. This is important because it rules out the possibility of a very specific and hence less practically significant impact from digital billboards. Stopping over the line suggests a failure to appropriately register the red state of the signals.*
>
> *This could result from 'back dropping' where colour contents in the billboard display are confusable with signal colours (see Austroads, 2013). The decrease in stopping over the line violations in the presence of the billboard suggests that such confusion did not occur in this evaluation. Stopping over the line violations could also result from change blindness for signal changes. While there is considerable evidence that distraction can increase change blindness in driving situations (e.g. McCarley et al., 2004) this research has mostly considered distraction from mobile phone conversations rather than external visual distraction. The decrease in stopping over the line violations in the presence of the billboard suggests that change blindness did not occur in this evaluation. Interestingly, a recent study by Pammer et al. (2014), although not concerned with a driving task per se, did find that under certain conditions in the laboratory that a visual distraction could reduce the incidence of change blindness.*
>
> *In conclusion, the current evaluation investigated the impact of the presence of digital billboards on vehicle control performance. The sites evaluated were relatively complex signalised intersections. Because of the cognitive demands associated with negotiating a signalised intersection, these are the kinds of sites where it might be expected that drivers would display impairment from distraction. <u>However, there was almost no evidence that the digital billboards at these locations impaired driving performance</u>. Clearly, in real world situations, the impact from the visual distraction from digital billboards is complex, and in some situations such as the installations evaluated here, there can be an apparent positive impact on driving performance from the presence of a digital billboard. If the parameters of how and when this positive impact occurs can be precisely specified, this would prove enormously valuable for all stakeholders."*
>
> [Underlining added.]

[2] Goodsell R, Dr Roberts. P (2018) "On-Road evaluation of the driving performance impact of digital billboards at Intersections" Project No. PRS17074 – ARRB

With respect therefore, the concerns that are implicit in the query regarding the number of image transitions that motorists may potentially be exposed to, and which is related to the operational dwell times, are perceived concerns that have no apparent evidentiary support from either the New Zealand-wide road safety history of digital billboards; the road safety performance of the subject billboard; applicable New Zealand standards and guidelines; or from research that is relevant to the manner that billboards are operated in New Zealand, (i.e. with 0.5-second dissolve transitions that do not create a visual flick that could otherwise catch the involuntary attention of a driver).

3 Query 2: Changes in Traffic Conditions

> *"Please provide an assessment of how traffic conditions at the Mt Wellington Highway interchange are expected to change following the opening of the nearby IKEA development (and any other major consented developments in the area). In particular, please explain how increased congestion may affect the frequency of billboard image changes experienced by drivers and the potential implications for distraction risk."*

Prior to delving into the impacts that other developments will have on the performance of the Mount Wellington Interchange, it is noted that:

a) The proposed variation in dwell time of the existing billboard will change neither existing nor future traffic demands that proceed through the interchange in general, or southbound through the southern of the two interchange intersections in particular.

b) As new developments in the broader area do come on stream (whatever they might be and whenever they might occur), it is inevitable that those developments will add to existing traffic demands on the road network, possibly including through the interchange to greater or lesser extents. Neither the existing presence of the billboard, nor the dwell time with which it operates, will impact on the effects that those additional travel demands will have on the performance of the interchange.

c) As traffic demands through the interchange increase over time, those increases will add to peak period 'congestion' which will manifest itself in terms of overall lower average speeds when moving through the interchange, (i.e. more queuing and delays). The only impacts that those lower average speeds will have in relation to the billboard, is that they will result in an increased probability that southbound motorists travelling through the interchange will be exposed to one or more image transitions. In this regard however, for the increased exposures to image transitions to be of any real consequence, the nature of the development(s) would have to be profound for it / them to materially degrade southbound travel times through the interchange's southern intersection.

This latter point will become apparent in following paragraphs in the examination of the effect on the interchange of the proposed 40,000 sqm IKEA and large format retail development that will be located (comparatively) close to the interchange on Carbine Road adjacent to the Syvia Park Metropolitan Centre. This is a large development that will generate 2.1 million visitors annually. In the Auckland context it can clearly be considered a major individual traffic generator.

In order to gain an understanding of the expected changes in traffic conditions due to the IKEA proposal, reference has been made to the Transportation Assessment that was

prepared for the IKEA resource consent application ("TA") [3]. In its assessments of the road network effects of the IKEA proposal, the TA included an analysis of the expected changes in performance of the Mt Wellington Interchange using SIDRA modelling. The conclusion reached in that report regarding the impacts of the IKEA development on the traffic performance of the interchange in general is summarised in its statement that:

> *"…the comparison between the existing and post-development scenarios demonstrate that the proposed development is not expected to have significant impacts on the operations of the interchange."*

In its assessment of the performance of the interchange, the TA looked specifically at three peak periods being:

a) Weekday midday peak hour (12:00 – 13:00);
b) Weekday evening peak hour (16:00 – 17:00); and
c) Saturday midday peak hour (12:15 – 13:15).

An examination of the SIDRA outputs provided in the TA for the southbound approach to the interchange's southern intersection, reveals negligible changes to the performance of that approach for all three peak periods. This is demonstrated in Table 2 below, where key measures of performance as output from the SIDRA modelling have been extracted and tabulated for each of the existing and 'with IKEA' demand flow cases, for each of the three peak periods that were examined.

MWH Southbound Performance	Approach Flow (vph)	Degree of Saturation	Avg Delay (secs)	95% Queue (veh)	Avg Speed (km/h)
Weekday Midday Peak					
Existing	871	0.41	12.3	11.4	40.5
plus IKEA	912	0.40	11.6	11.3	41.2
Weekday Evening Peak					
Existing	968	0.43	1.6	0.8	51.8
plus IKEA	998	0.43	1.6	0.9	51.8
Saturday Midday Peak					
Existing	1200	0.52	2.0	1.2	50.8
plus IKEA	1275	0.53	1.9	1.2	51.0

Table 2: MWH Interchange southern intersection – southbound approach - key performance measures – existing versus existing plus IKEA (data source: IKEA TA)

Of the metrics provided in the above table, the one that perhaps assists most when considering the potential interactions between increased southbound traffic demands and the road safety effects of the operational image dwell time for the subject billboard, is average travel speed. As noted above, if average southbound travel speeds through the interchange were to materially reduce, then this would increase the potential exposure of motorists to more image transitions. As is apparent from the above table however, the average speeds barely change at all. While the weekday midday peak actually shows a

[3] Commute Transportation Consultants "*Proposed IKEA and Large Format Retail Development – Sylvia Park, Mt Wellington*", 14 October 2021

marginal speed increase of 0.7-seconds, when all three speeds for each peak period are rounded to the nearest whole number[4], it shows travel speeds that remain effectively unchanged.

Given then, the essentially nil change in traffic conditions (as far as the operation of the billboard is concerned), due to what will be a massive traffic generator in close proximity to the interchange, there would be little practical value in trying to identify other smaller individual proposed developments that are further from the interchange, as even when considered cumulatively, they are unlikely to show anything that is materially different when considering southbound traffic performances on the visible approach to the billboard.

4 Query 3: Trucks blocking visibility of traffic signals

> *"In Section 3.3.4 of the applicant's Traffic Engineering Report (TER), the applicant's traffic specialist refers to the traffic signals in the dual primary and secondary positions for the southbound approach to the intersection of Mount Wellington Highway and the SH1 Motorway northbound on-ramp and southbound off-ramp stating that:*
>
> > "The prominence of the apparently closely spaced dual primary and secondary signals (each of which has six aspects arranged in two columns) clearly dominates in terms of conspicuity of the full traffic signal set that faces southbound road users."
>
> *The TER does not acknowledge the possibility of trucks restricting visibility of the dual primary or secondary signal displays or assess the potential adverse effects. Please provide an updated traffic assessment, commenting on potential effects of the proposal, taking into account the possibility of trucks blocking the visibility of the dual primary or secondary signal displays, which may force southbound drivers to rely on the signals in the primary and tertiary positions, which have an overlap with the billboard."*

As the variation proposal does not anticipate any physical changes to either the subject billboard or the layout of the intersection, any incidences of a large truck obstructing views of one or both of the dual-primary and/or secondary traffic signal lanterns[5] for motorists following the truck will not change.

If a large truck was to obstruct both the dual-primary and secondary signals, the query correctly observes that following drivers will be required to rely on the primary and/or the tertiary signals. This is an existing situation that does not change with the proposal.

It is also worth noting in this regard that none of the crashes that have occurred at the intersection (refer Section 4.1 of the TER), referred to obstruction of view of a traffic signal lantern as being a contributing factor.

What is inferred, but not specifically requested in the query, is the possibility that the increased frequency of image change will in some way degrade the ability of motorists to observe or respond to either the primary or tertiary signal if views of the dual-primary and secondary are obstructed. The short answer is that they will not.

Section 3.3 of the TER has addressed in detail the relationship between the billboard screen and the traffic signals.

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[4] Which is appropriate as the results output by SIDRA expressed to one decimal place actually implies a level of accuracy that is greater than appropriate for the nature of the model

[5] These are the two traffic signal heads on the right-hand side of the road as illustrated in Figure 5 of the TER

When motorists have to, or wish to, rely on the primary and/or tertiary signals to be informed about whether or not they able to proceed straight through the intersection (the primary and tertiary signals do not inform the right turn onto the northbound on-ramp), even when there is a visual overlap with the billboard, this does not make either of the two traffic signals invisible, nor does it compromise a motorist's ability to recognise their displays despite the contrary perception inferred by the query. This is amply demonstrated in Figures 8 and 13 of the TER, which have been reproduced below, and which show a driver's view of the existing visual overlapping in each of Lane 1 and Lane 2, (Lane 3 views are irrelevant as Lane 3 is a right turn-only lane, and the primary and tertiary signals do not inform the right turn). In each of the Lane 1 and Lane 2 views, the prominence of the primary traffic signal in the foreground is readily apparent. The proposed modification to the dwell time will not diminish that prominence.

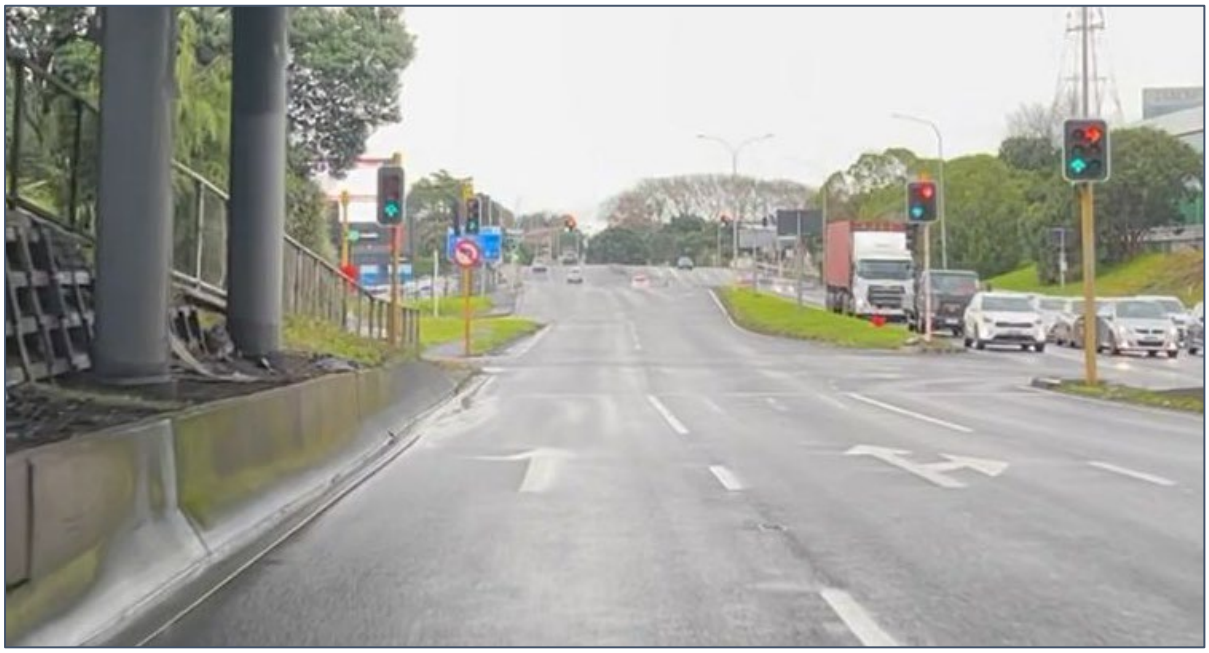

Figure 1: Lane 1 commencement of plan view visual overlap (~40.5m from limit line)

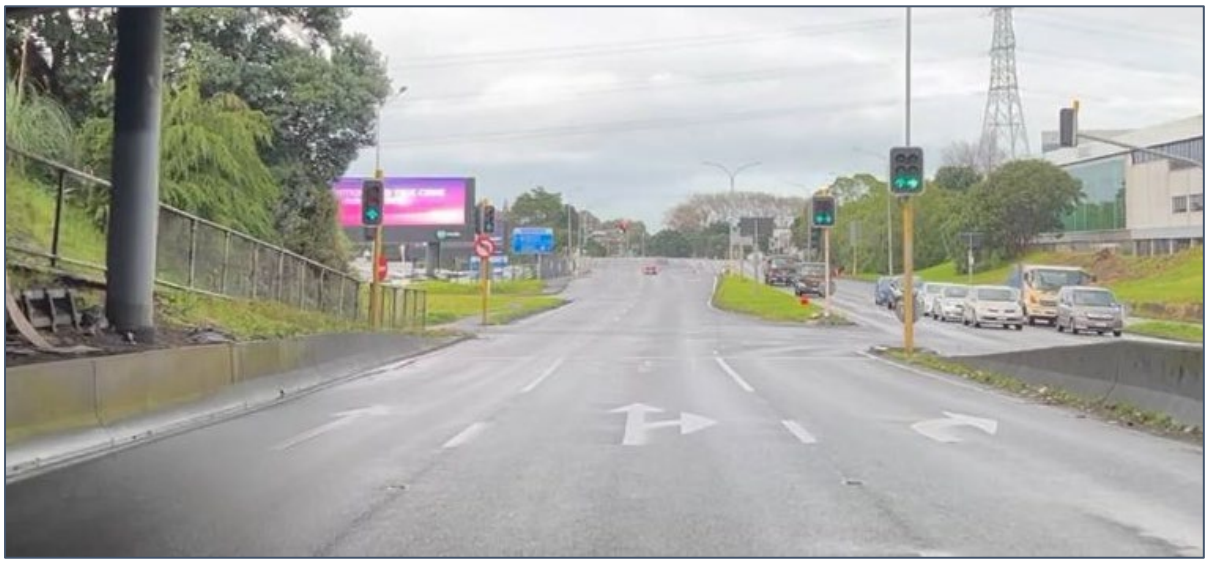

Figure 2: Lane 2 mid-point of visual overlap (~53m from limit line)

5 Query 4: Operational effects due to a crash

> *"The TER does not assess the potential operational effects on the road network should a crash occur. The Mount Wellington Highway / SH1 Motorway interchange carries high traffic volumes and operates close to capacity during periods of peak traffic flow. A crash in or near the intersection, even if it does not result in injury to vehicle occupants, may potentially adversely affect the operation of the road network. Please provide commentary on this matter."*

If a crash was to occur at the MWH / off-ramp intersection, then depending on exactly where in the intersection it occurred; the seriousness of the crash; and the timeliness of moving or removing the crash vehicles, then there is a possibility that the off-ramp would become restricted in its use, or even potentially blocked for a period. Either way, following any incident that restricted or stopped the function of the off-ramp, it is assumed that incident management would kick in, (such as motorway gantry VMS messages advising motorists to avoid the off-ramp for instance). For particularly serious incidents that occur in peak hours, there is a reasonable probability that queue-back effects onto the motorway's southbound mainline could occur.

However, examination of potential impacts to the Southern Motorway is a purely academic exercise in this case. This is because there is no demonstrable and/or credibly realistic evidence of such effects occurring now, nor is it considered likely that the proposed variation to the dwell time will produce such effects. As described in the TER, there is no probative evidence from the 13 years of digital billboard operations in New Zealand, nor particularly from the 3½ years operation of the subject billboard, to indicate that they are generating crashes as a result of image changes (or any other reason). Given this unblemished New Zealand-wide history of digital billboard operational safety, it is considered an unrealistic stretch to suggest that it will be suddenly compromised by varying the dwell time of the subject billboard to match that as currently applies to more than 90% of the digital billboards in New Zealand.

Hence the conclusion that examination of traffic queue-back effects onto the Southern Motorway due to a crash at the off-ramp intersection is an academic exercise that in practice will have little or no relevance to consideration of the likely effects to be generated by the proposed image dwell variation.

6 Analysis and conclusions

Based on the assessments provided above, it is considered that the concerns inferred by the RFI queries regarding the safety and operational implications of the proposed dwell time reduction for the north-facing billboard screen (from 30 seconds as existing, to 8-seconds as proposed), are unsupported by the evidence regarding dwell times.

It is important to repeat that the digital billboard that is the subject of this application is existing, and has done so successfully for the past 3½ years with no evident effects to either road safety or traffic operations at the MWH / SH1 ramp intersection, or the operation of the Southern Motorway. Demonstrably, the digital billboard with its 30-second operating dwell time can be considered as a compatible component of the traffic environment within which it operates.

The nature of the RFI queries appear to posit the view that the reduction in dwell time from 30-seconds to 8-seconds, (with nothing else about the billboard's location, orientation or

operation that changes) will, in and of itself, materially degrade road safety and traffic operations to such an extent that the proposal cannot be supported. This is despite that the evidence, both research-based and experiential in New Zealand, both clearly indicate otherwise. It is noted in this regard that over the past 3½ years, some 14.3 million drivers have travelled south past the billboard[6], and there have been 3.6 million image changes, yet there have been zero identified adverse road safety outcomes.

For most motorists travelling through the intersection, the increase in potential maximum exposure to a transition will increase from one as occurs currently, to generally two. The likelihood that one additional 0.5-second dissolve transition between images will produce any identifiable change to the road safety performance of the local traffic environment is considered highly remote.

The TER has provided details of the available evidence that supports the proposal, and has provided clear analyses and assessments that support the contention that the concerns inferred by the RFI queries are without credible evidentiary bases. Indeed, the intended 8-second dwell time for the subject billboard will be no different to the estimated 90% or more of the 550+ digital advertising screens that currently operate in Auckland, and the 550+ that operate elsewhere throughout New Zealand, that have successfully and demonstrably achieved an unblemished road safety record while applying an 8-second dwell time for images.

If anything, the responses provided in this memorandum further confirm the assessments and conclusion of the TER that the proposed variation to enable an 8-second dwell time can be achieved in the knowledge that the potential adverse road safety effects due to the proposed 8-second dwell time will in practice be less than minor, if not negligible. Accordingly, it can be confirmed that the proposed dwell time variation will be appropriate and acceptable from both traffic operations and road safety perspectives. it is fully supported by research and practical trials; it is consistent with industry best practice in New Zealand; and it will ensure that appropriate levels of road safety are maintained.

B Harries
Harries Transportation Engineers

[6] Based on a February 2024 traffic count that recorded a 7-day average southbound traffic volumes of 11,572 vehicles per day (travelling south on MWH as measured south of the interchange). Refer Section 2.1.2 of the TER