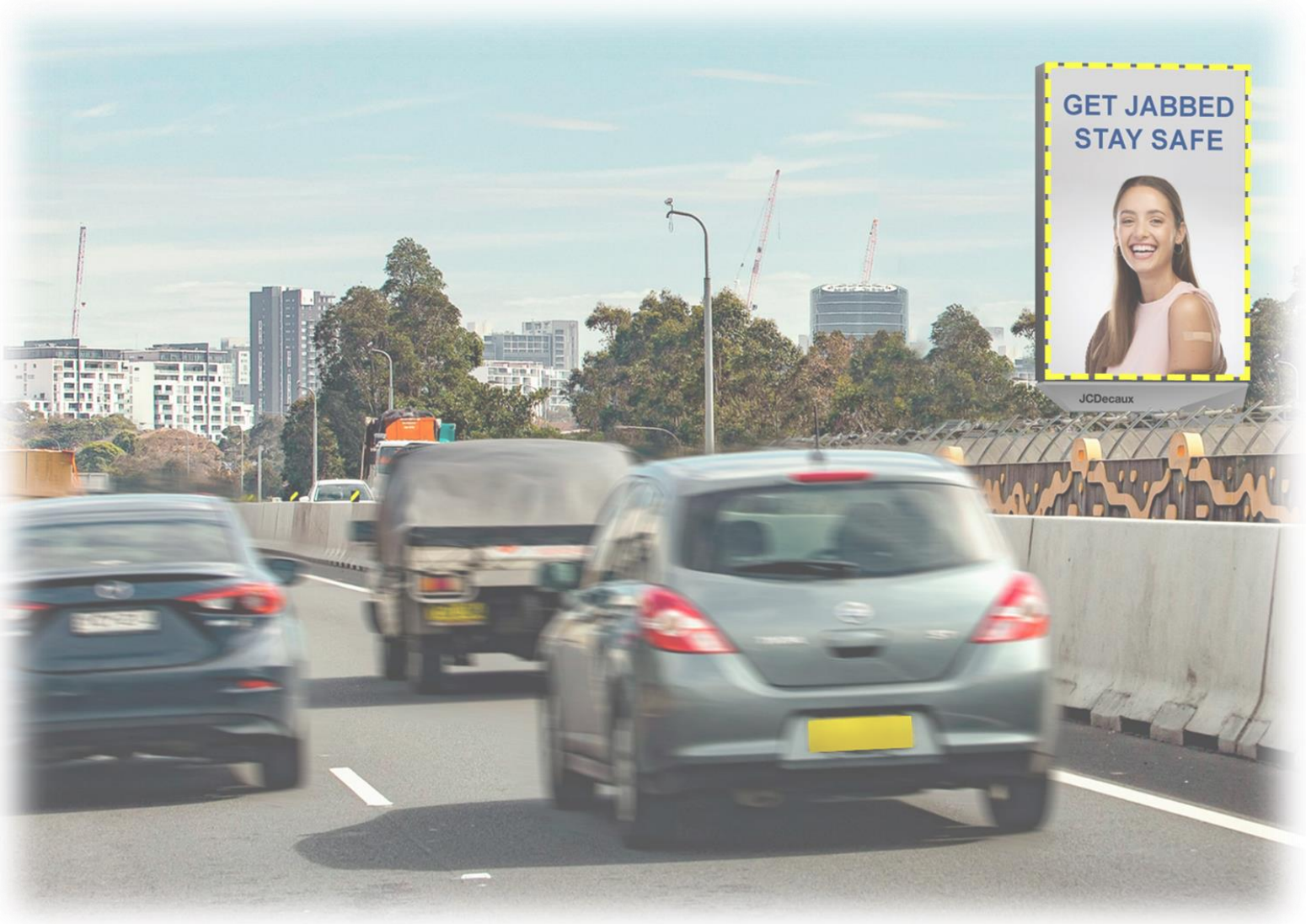
M4 Western Motorway, Rosehill

Proposed Outbound Digital Sign Traffic Safety Assessment

JCDecaux

7 November 2022



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The assessment team has undertaken assessments of similar digital advertising sign proposals elsewhere in NSW and Australia. In addition to the use of NSW guidelines, our assessments are founded on road safety auditing principles and traffic safety risk assessments. Where a significant change in road safety risk has been identified due to the proposal, potential treatment measures to mitigate the change in risk have been suggested. However, the adoption of any or all the treatment measures does not warrant that the site is absolutely safe from incidents in the future whether they be related or unrelated to the proposed digital sign.

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1. INTRODUCTION

1.1 Background

JCDecaux is seeking development approval for the conversion of an existing static landscape advertising sign to a digital LED portrait advertising sign. The sign is located on the northern side of the M4 Western Motorway (M4), east of the former Carlingford Railway Line, in Rosehill as shown in Figure 1.1.

**Digital sign location is indicative.*
Adapted from Nearmap

Figure 1.1: Location of the Existing Static Sign and Proposed Digital Sign

Bitzios Consulting has been engaged by JCDecaux to undertake a traffic safety assessment of the proposal.

The proposed development plan is provided in **Appendix A**.

1.2 Methodology

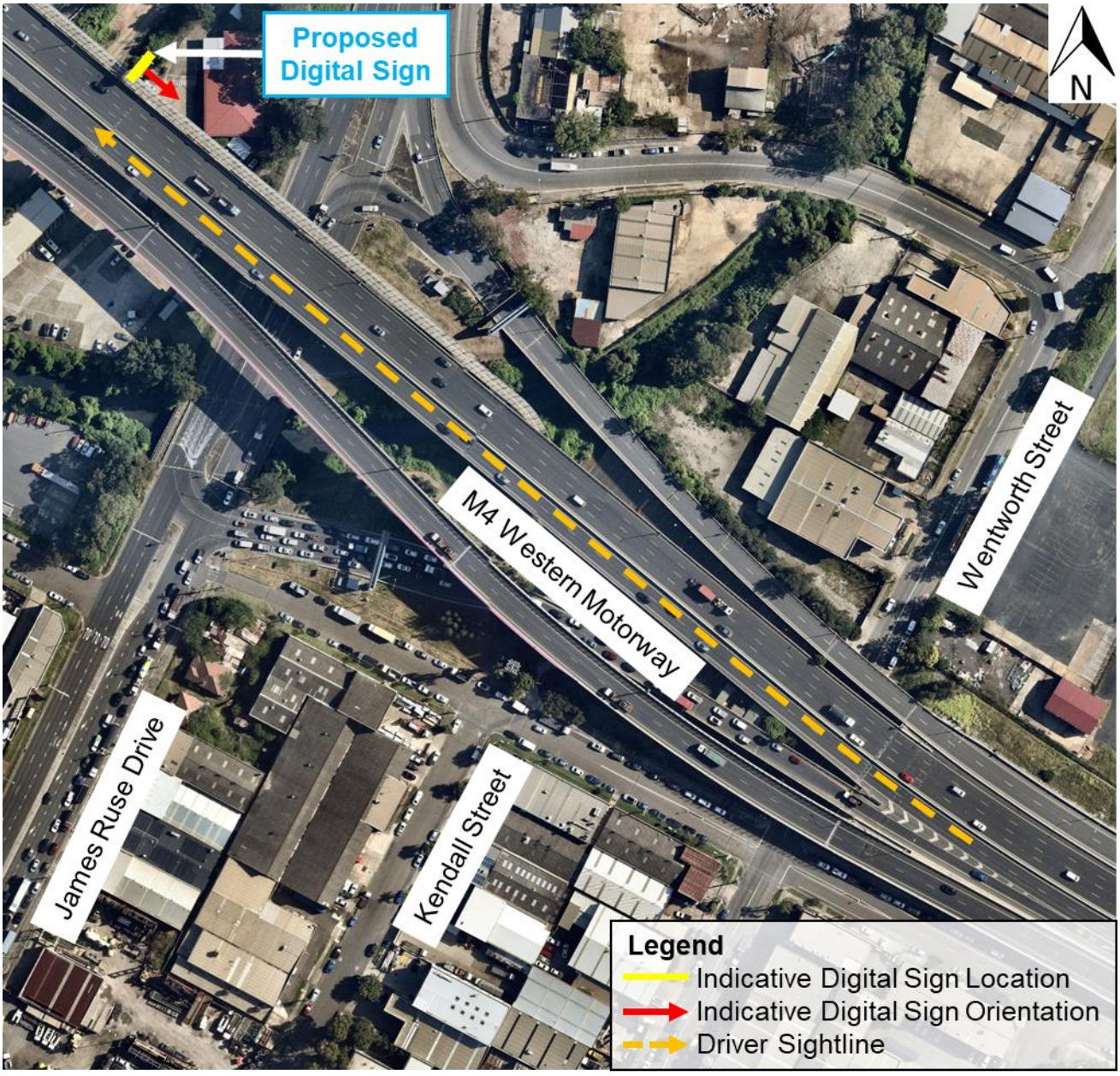
The process used to assess the impact of the proposal involved:

- A review of the viewing locations and sightlines to the existing site and hence the proposed digital sign to define the geographical scope of the assessment
- A review of the existing static sign and proposed digital sign specifications
- A review of relevant research and case study examples of the effects of digital signs on driver distraction in different driving circumstances
- Site inspections during day and night conditions to understand the road user's perspective of the sign, then a driver sightline assessment using images captured from in-vehicle video recordings
- A first-principles safety assessment of the proposed digital sign, including reviewing road approaches, driver sightlines, surrounding environment and proximity of intersections
- A review of the most recently available five years of crash data in proximity to the sign
- An assessment of the proposed digital sign against:
  - State Environmental Planning Policy (Industry and Employment) 2021 (Industry and Employment SEPP)
  - The Transport for NSW Advertising Sign Safety Assessment Matrix
  - The *Transport Corridor Outdoor Advertising and Signage Guidelines: Assessing development applications under SEPP 64 (Department of Planning and Environment, November 2017)* (*Signage Guidelines*).

2. SIGN VIEWING LOCATIONS

2.1 Viewing Approaches

The digital sign will face south-east towards westbound drivers along the M4, mainly lanes 3 and 4. The driver sightlines to the sign from this approach are illustrated in Figure 2.1.



**Sign location is indicative.*
Adapted from Nearmap

Figure 2.1: Driver Sightlines to the Proposed Sign

2.2 Driver Views

The westbound sign views from the M4 during the day and night-time periods are shown in Figure 2.2 and Figure 2.3 respectively (*note: that the static sign in the background is proposed to be removed as part of the proposal*).

**Sign location is indicative, not to scale and for illustration purposes only.*

Figure 2.2: Daytime view from the M4 westbound

**Sign location is indicative, not to scale and for illustration purposes only.*

Figure 2.3: Night-time view from the M4 westbound

3. STATIC AND DIGITAL SIGN SPECIFICATIONS

The specifications for the existing static sign and the proposed digital sign, as well as other relevant site information, are summarised in Table 3.1.

Table 3.1: Specifications and Site Information for the Static and Digital Signs

Attribute	Details
Location	Northern side of the M4, east of the former Carlingford Railway Line, Rosehill, NSW
Local Government Area	Parramatta
Land use zoning	SP2 Classified Road
Existing and proposed facing direction	South-east
Existing type of advertisement/sign	Freestanding advertisement – supersite
Proposed type of advertisement/sign	Freestanding advertisement – portrait
Existing display format	Externally illuminated general advertising
Proposed display format	Internally illuminated digital (LED)
Existing visual screen size	12.65m x 3.46m = 43.77m^2
Proposed visual screen size	8.00m x 5.30m = 42.40m^2
Proposed advertising display area	8.15m x 5.45m = 44.42m^2
Visual screen size greater than 20m^2?	Yes – overall height 21.30m
Visual screen size greater than 45m^2?	No
Structure higher than 8m above the ground?	Yes
Is the site located within 250m of and visible from a classified road under the *Roads Act 1993*?	Yes
Consent authority	NSW Minister for Planning
Does the sign contain moving parts?	No
Is it a Variable Message Sign?	No
Does it have any flashing or flickering content?	No

4. LITERATURE REVIEW

4.1 Context

Crashes directly related to digital signs would typically fall into two categories:

- Crashes due to the collision of a vehicle with the mounting structure of a digital sign where the sign in placed in a location where there is a reasonable risk of this occurring
- Crashes which occur as a consequence of a driver being distracted by a digital sign.

The available *Digital Signage Guidelines* generally provide well-researched information on the location of 'clear zones' and other areas where there is a reasonable risk of an object being collided with by an errant vehicle. The linkages between driver distraction due to digital signs and crashes is less well dealt with in the available *Digital Signage Guidelines* and many of the criteria used have no direct relevance of the risk of distraction in time and in space on approach to digital signs located in different parts of the visual driving environment and in different driving environments.

The chain of events that is required to link a digital sign to increased crash rates is that:

- *A driver is aware of an external event (i.e. outside the vehicle) which is a digital sign display change and that the event distracts a driver sufficiently to lead to involuntary driver inattention which then leads to driver error at a critical time in a driving environment and driving circumstance that leads to a crash.*

As there is no body of research that links the installation of a digital sign or the conversion of a static sign to a digital sign to increased crash rates, the available research has been disaggregated into:

- The relationship between distractions (generally) and crashes
- The relationship between digital signs and distractions
- Studies which have attempted to interpret before v after installation crash statistics to see if there is a correlation of digital signs with crash rates (without defining a causal relationship).

Research on each of these topics is summarised below.

4.2 Relationships between Distraction and Crashes

It is important to note that distraction from digital or static billboards did not feature in the top 15 causes of driver distraction. As such, this data further validates the research consensus that there is no valid link between roadside advertising and increased crash risk. There is consensus in the literature that the majority of crashes which occur in urban areas are due to driver error. Victor et al. (2005) highlights that human error is the cause of up to 92.6 percent of accidents on the road. In order to minimise the risk of crashes drivers need to: be aware of external environmental influences, interpret the risks associated with these external environmental influences, make decisions, and carry out actions (Perez & Bertola 2011).

Even though human error is the cause of most crashes, Lam (2002) reviewed NSW crash data and found that out of 414,136 crashes, distraction was a factor in 15,059 (3.6%) of them. Distractions coming from outside the vehicle were determined to be a factor in only 2.5% of all crashes. This low influence of external distractions to crashes was reinforced by the Monash University Accident Research Centre (MUARC) carried out a study on crashes in Victoria and NSW between 2000 and 2011 and found the most common causes of crashes as summarised in Table 4.1. The most common cause of crashes was a combination of driver inattention and driver distraction. Distraction and inattention may occur separately. That is, a driver may be distracted but still attentive.

Table 4.1: Causes of Vehicle Crashes in NSW and Victoria

Percentage of Crashes	Cause
13.5%	Intoxication
11.8%	Fell asleep
10.9%	Fatigued
3.2%	Failed to look
3.2%	Passenger interaction
2.6%	Fell ill
2.6%	Blacked out
1.8%	Feeling stressed
1.5%	Looked but failed to see
1.4%	Animal or insect in vehicle
0.9%	Using a mobile phone
0.9%	Changing CD/cassette/radio
0.9%	Adjusting vehicle systems
0.9%	Looking at vehicle systems
0.3%	Searching for objects

Source: http://www.keepyoureyesontheroad.org.au/pages/Accident-statistics-Cont

Austroads (2013) provides a comprehensive review of research on the effect of roadside advertising on road crashes. It found from its extensive literature review that *"while looking at an external object appears to be quite risky behaviour when it is engaged in, it is not a frequent cause of crashes overall"*.

Many studies have been undertaken to determine the main causes of both driver distraction and driver inattention, and how they contribute to an increase in crashes. Regan et al. (2011, p.1771) describes driver distraction as a *"diversion of the mind, attention, etc., from a particular object or course; the fact of having one's attention or concentration disturbed by something"*. This includes objects brought into the vehicle, vehicle systems, vehicle occupants, moving objects or animals in the vehicle, internalised activity, and external objects, events or activities (Perez & Bertola 2011). A broader definition of driver inattention is defined as *"when the driver's mind has wandered from the driving task for some non-compelling reason"* (Regan et al. 2011, p.1772).

4.3 Relationships between Digital Sign Glances and Distraction

Samsa (2015) conducted a study that used eye tracking technology to track participant's natural eye movements and prioritisation behaviour whilst driving. Participants were each instructed to drive a single loop of the study route (14.6km section of a road through Brisbane and its surrounding suburbs to Woolloongabba) between 11am and 2pm. This study found that participants prioritised tasks based on the complexity of the driving demands, which was particularly evident during heavy traffic in AM and PM peak hours. The research found that in demanding driving environments, drivers will prioritise focussing on "on-road" factors such as the rate of cars braking and on pedestrian and cyclist movements over off-road factors such as billboards. Moreover, Samsa (2015) found no significant difference in driver prioritisation when comparing static billboards, digital billboards and on-premises signs. This research concluded that there is a smaller chance of driver distraction from digital billboards whilst driving in demanding environments.

The Samsa (2015) finding supported the US Department of Transport and Federal Highway Administration research (2012) which found that drivers look at the forward roadway between 73% and 85% of the time depending on the demands of the driving task. This study also found that where billboards are introduced, drivers may substitute saccades / glance fixations from other things towards billboard glances but the percentage of time fixating on the forward roadway is consistent.

Victor et al. (2005) revealed similar results when they undertook a much larger study that examined eye glance movement on the road during both light and heavy traffic flows. Data was collected via the EU project HASTE, which used "in vehicle information systems" (S-IVIS). Data was sourced from 119 participants across three separate experiments, from four separate driving routes. The study included an examination of auditory and visual tasks to test driver glance behaviour. The results showed that as driving tasks became more difficult, drivers increased their viewing time in the road centre, rather than on other visual tasks (such as observing signs) off-road.

Also, there are general misconceptions that drivers "stare" at digital billboards, that changing messages on digital billboards draw a driver's attention to them and that these influences alone lead to crashes. The literature suggests that instead of "staring" at billboards, drivers "glance" at billboards. The US Department of Transport and Federal Highway Administration (2012) found that the average glance duration to an electronic billboard was 0.335 seconds with a maximum of 1.335 seconds, well below the 2.0-second distraction time threshold that Austroads research (and other research) suggests as the critical time for increased crash risk. Smiley et. al. (2005) found an average glance length of 0.5 seconds for electronic billboards and that viewings of the electronic billboard were undertaken by up to 50% of drivers.

The research of Decker et al. (2015) supported the glance time findings of other studies. This research summarised the results of 8 studies and concluded that the "*range of mean glance durations was 0.27 to 0.953 s (mean, 0.51) for passive billboards and 0.27 to 1.0 s (mean, 0.54) for active billboards*". This research did note "*strong evidence of substantial variability among individual billboards in each category"*.

Participant's glance behaviour was recorded and analysed in terms of the number of fixations and the duration of these fixations to both static and digital billboards in the work of Samsa (2015). Out of a total of 144 fixations toward four digital billboards, the average fixation duration was below 0.75 seconds. This is considered to be *"the equivalent minimum-perception reaction time to the slowing of a vehicle ahead"* (Samsa 2015, p.8). Less than 1% of the records presented an average fixation duration of above 0.75 seconds. This average was apparent for both static and digital sign types. Furthermore, Samsa's (2015) results showed that participants that fixated on a digital billboard for longer than 0.75 seconds tended to do so when travelling conditions were relaxed (i.e. car was stationary, or traffic was minimal).

Samsa's (2015) results followed those of Perez and Bertola (2011) which also used eye-tracking technology to survey driver behaviour when glancing to digital billboards. Perez and Bertola (2011) also found that the maximum glance duration off the centre of the road was 0.75 seconds and claimed that that these small glances away from the road generally occur when there is low demand from the road network, and that these glances are not likely to result in adverse or critical events. Overall, a number of studies have concluded that drivers glance at digital billboards at a mean rate of 0.5 seconds and almost all are less than 1.0 seconds.

The available literature confirms that:

- External sources have a minimal effect on driver distraction that led to crashes
- Driver distraction in general reduces as the driving environment becomes more complex because drivers prioritise their attention effort to higher risk tasks
- The number and duration of glances due to digital billboards that result in driver inattention to the scale that might influence the series of events that would lead to a crash is immeasurably small.

4.4 The Relationship between Digital Signs and Crashes

4.4.1 International Examples

Due to the relatively short time digital billboards have been present in Australia and the relatively few locations that they have been present (until recent years), there is limited before and after installation crash data in Australia that specifically targets identifying a relationship between digital signs and crash rates and under what conditions. A selection of international research is presented below.

Hawkins, Kuo and Lord (2012) was based on 135 "on-premises digital sign" locations and undertook statistical analysis of crash data for before and after each sign installation. The signs were located in California, North Carolina, Ohio, and Washington. This study concluded "that the installation of digital on-premises signs does not lead to a statistically significant increase in crashes on major roads".

Tantala and Tantala (2010) was based on "26 existing, non-accessory, advertising digital billboards along routes with periods of comparison as long as 8 years in the greater Reading area, Berks County, Pennsylvania". This research looked at both temporal and spatial crash details around the electronic signs and compared the data to 51 non-electronic signs. The digital signs had message duration times of 6, 8 or 10 seconds. This research concluded that:

- *"The before and after rates of accidents near the twenty digital billboards show an 11.1% decrease within 0.5 miles of all digital billboards over eight years near twenty locations. Similar decreases and trends in both averages and peaks are observed for both smaller and larger vicinity ranges, and for specific groups of locations by duration time."*
- *"The accident statistics and metrics remain consistent, exhibiting statistically insignificant variations at each of the digital billboards. The metrics include the total number of accidents in any given month, the average number of accidents, the peak number of accidents in any given month, and the number of accident-free months. These conclusions account for variations in traffic-volume and other metrics."*
- *"The statistical evaluation of the Empirical Bayes method and actual versus predicted results show that the total number of accidents is comparable to what would be statistically expected with or without the introduction of digital technology and that the safety near these locations is consistent with the model benchmarked by 77 locations within Berks County."*

Pandey and Shafizadeh (2011) reviewed a range of traffic flow parameters upstream of electronic billboards on Highway 50 near Sacramento. The study concluded that *"the presence of the electronic billboard does not appear to have a significant negative impact in traffic performance (flow, speed, and lane occupancy) or incidents in the study section of the freeway"*.

4.4.2 Local Examples

Constitution Hill

Bitzios Consulting reviewed available crash data on the Cumberland Highway, Constitution Hill (see Figure 4.1), where a digital sign was installed in February 2017. The installation of a digital sign did not result in an increase in crash rates at that site. The crash data for both pre- and post-installation of the digital sign was compared as shown in Table 4.2 to confirm the findings of the available research. It is to be noted that the crash comparison data is available only up to 2017 and 2018.

Adapted from Nearmap

Figure 4.1: Location of an Existing Digital Sign in Constitution Hill

Table 4.2: Crash Comparison Pre and Post-installation – Constitution Hill (2013-2017)*

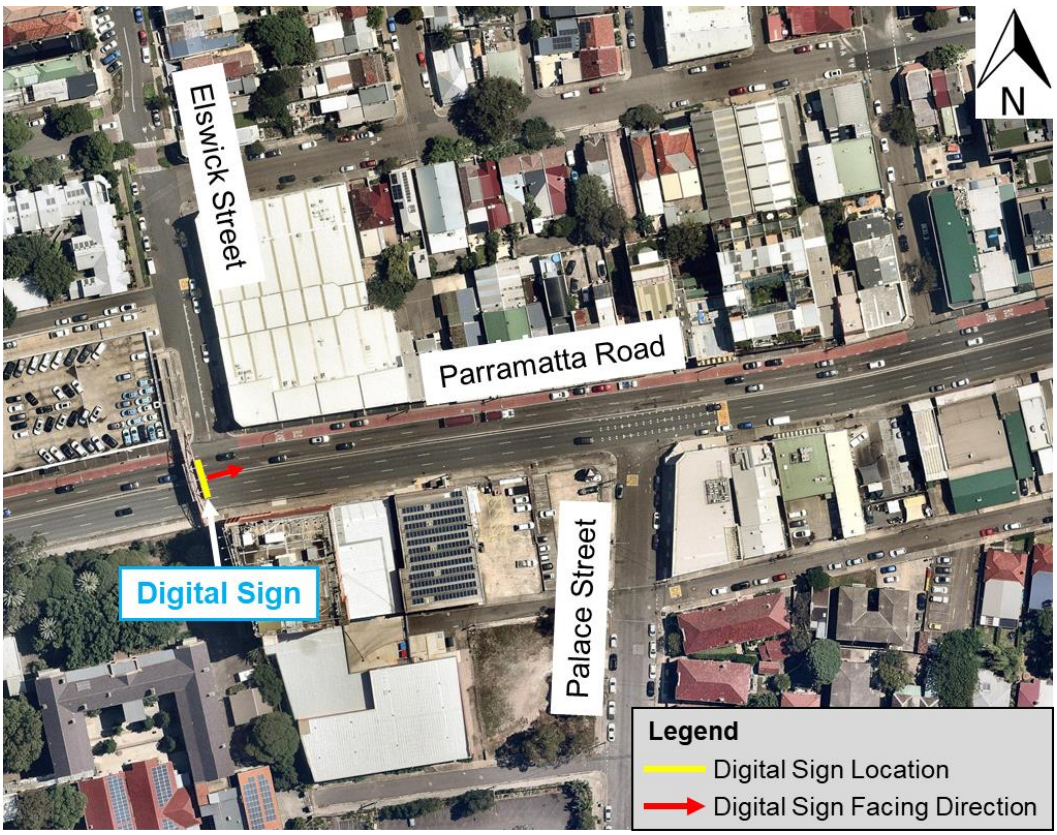
Year	Crash Degree					Total
	Fatal	Serious Injury	Moderate Injury	Minor/Other Injury	Non-casualty (towaway)	
Pre-installation						
2013	-	1	1	1	3	6
2014	-	-	1	1	2	4
2015	-	-	2	-	-	2
2016	-	-	-	3	-	3
Total	**-**	**1**	**4**	**5**	**5**	**15**
Post-installation						
2017	-	1	-	2	1	4

**2018-2020 crash data not available.*

The above table shows no increase in crash rate after the installation of the digital sign. Whilst based on a limited sample, this data further supports the research of the absence of a link between roadside digital advertising signage and crashes.

Petersham

Bitzios Consulting reviewed available crash data on Parramatta Road, Petersham (see Figure 4.2), where a digital sign was installed in May 2017. The crash data both pre- and post-installation of the digital sign was compared as shown in Table 4.3 to confirm the findings of the available research.



Adapted from Nearmap

Figure 4.2: Location of an Existing Digital Sign in Petersham

Table 4.3: Crash Comparison Pre and Post-installation – Petersham (2013-2017)*

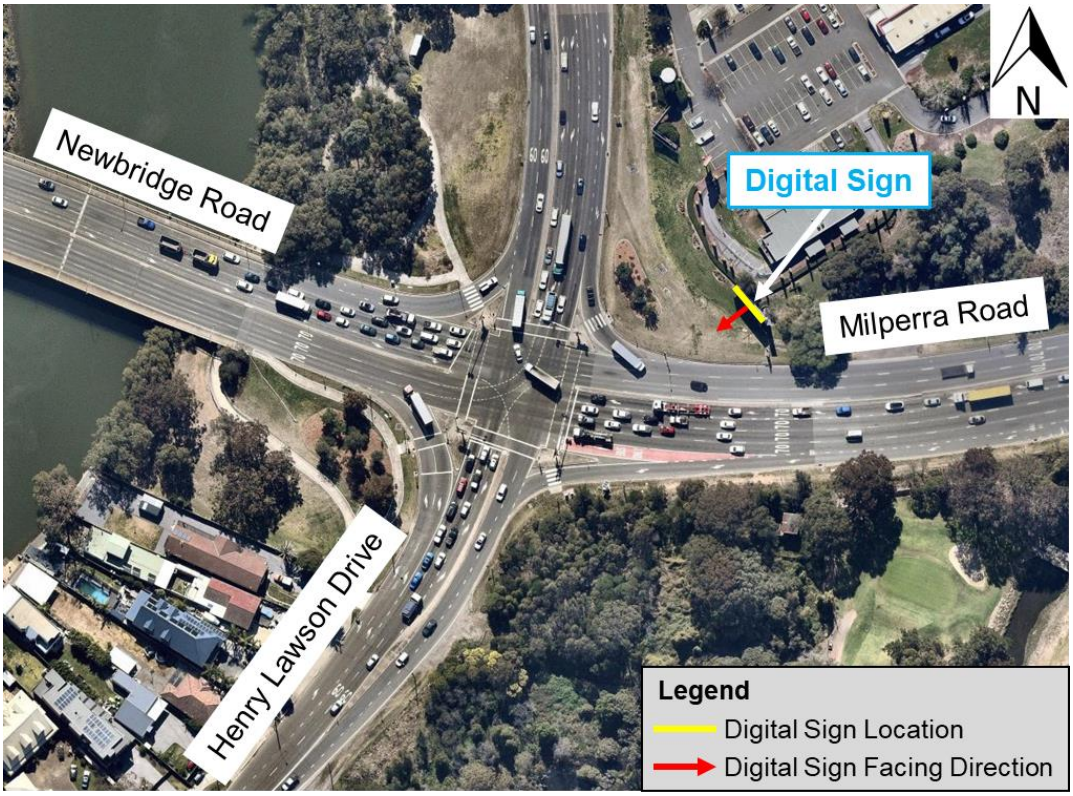
Year	Crash Degree					Total
	Fatal	Serious Injury	Moderate Injury	Minor/Other Injury	Non-casualty (towaway)	
Pre-installation						
2013	-	-	-	-	1	1
2014	-	-	1	-	1	2
2015	-	-	-	-	-	-
2016	-	1	2	-	-	3
2017	-	-	-	-	-	-
Total	**-**	**1**	**3**	**-**	**2**	**6**
Post-installation						
2017	-	1	1	-	-	2

**2018-2020 crash data not available.*

The above table shows no increase in crash rate after the installation of the digital sign. Whilst based on a limited sample, this data further supports the research of the absence of a link between roadside digital advertising signage and crashes.

Milperra

Bitzios Consulting reviewed available crash data near the corner of Milperra Road, Newbridge Road and Henry Lawson Drive, Milperra (see Figure 4.3), where a digital sign was installed in August 2018. The crash data both pre- and post-installation of the digital sign was compared as shown in Table 4.4 to confirm the findings of the available research.



Adapted from Nearmap

Figure 4.3: Location of an Existing Digital Sign in Milperra

Table 4.4: Crash Comparison Pre and Post-installation – Milperra (2014-2018)

Year	Crash Degree					Total
	Fatal	Serious Injury	Moderate Injury	Minor/Other Injury	Non-casualty (towaway)	
Pre-installation						
2014	-	3	1	3	3	10
2015	-	2	2	3	3	10
2016	-	1	1	4	1	7
2017	-	1	5	5	1	12
2018*	-	-	-	3	-	3
Total	**-**	**7**	**9**	**18**	**8**	**42**
Post-installation						
2018*	-	-	1	1	1	3

**Only preliminary data was available at the time of this assessment.*

The above table shows no increase in crash rate after the installation of the digital sign. Whilst based on a limited sample, this data further supports the research of the absence of a link between roadside digital advertising signage and crashes.

4.5 Recent Rulings by the Court

4.5.1 Planning and Environment Court of Queensland – Gold Coast

In May 2015, the Planning and Environment Court of Queensland upheld an appeal against refusal of a digital sign on Bundall Road, an urban arterial road near a signalised intersection on the Gold Coast on the basis that there was insufficient evidence to support the link between digital signs and road safety risk changes. The case is cited in *Malchada Pty Ltd v Gold Coast City Council [2015] QPEC 21*. The court ruled that the appeal be allowed, subject to operating conditions. The Commissioner concluded that:

- In terms of the intersection between Bundall Road and Ashmore Road, *"I note that …. there is only one accident for about every two million vehicles which pass through it and that it was performing 'pretty safely' "*.
- *"A detailed analysis of the intersection failed to convince me that it was dangerous."*
- *"On the evidence before me, I am satisfied that the proposed development is safe from a traffic perspective."*

4.5.2 Land and Environment Court of NSW Ruling – Kogarah

In April 2017, Outdoor Systems Pty Ltd (the applicant) sought approval from the Land and Environment Court of NSW to allow for a 15 second dwell time for a new digital sign on the Princes Highway, Kogarah. In assessing the application, Transport for NSW was concerned that the dwell time proposed for the sign did not address SEPP 64 Schedule 1 and did not comply with its *2015 Draft Guidelines*. Transport for NSW's position was that the sign should remain as a static sign and recommended that Georges River Council refuse the application. An appeal was lodged, and the case is cited in *Outdoor Systems Pty Ltd v Georges River Council and Roads and Maritime Services [2017] NSWLEC 1505*.

The Commissioner found that in this case there was no evidence that digital signs contribute to crashes. Key statements included that:

- *"After careful consideration of all of the evidence I must agree with Ms Samra's assessment that the scientific literature is vastly inconclusive of any direct evidence that digital billboards contribute to crashes."*
- *"While billboards are clearly designed to attract attention there is no satisfactory evidence before me to conclude that there is a significant difference in average fixation durations between digital and static billboards."*

In reaching his determination, the Commissioner noted the importance of considering each case on its merit.

4.5.3 Environment, Resources and Development Court of South Australia – Adelaide

In August 2017, the Environment, Resources and Development Court of South Australia upheld an appeal, subject to operating conditions, against refusal of a digital sign replacement of an existing static sign adjacent to a signalised intersection in North Adelaide. The case is cited in *oOh! media Pty Ltd v The Corporation of the City of Adelaide [2016] ERDC 297*. The Commissioner considered that *"the change to an LED sign as proposed is unlikely to materially change the risk factors nor will it put into jeopardy the safety of the public at this intersection"*.

4.6 Research Interpretation

The chain of events that is required to link a digital sign to increased crash rates is: *a driver is aware of an external event (i.e. outside the vehicle) which is a digital sign display change and that the event distracts a driver sufficiently to lead to involuntary driver inattention which then leads to driver error in a driving environment at a critical instance in time that leads to a crash"*.

The combination of probabilities of these events would be extremely difficult to quantity and aligns with the absence of a comprehensive body of research that links digital signs (to driver distraction leading to driver inattention leading to driver error) leading to an increased rate of crashes.

The literature review presented in this chapter has established an absence of a causal relationship between digital signs and driver distraction to the level that creates additional crashes.

Furthermore, there is also an absence of any correlation between new digital signs and increasing crash rates. There are currently over 2,000 digital roadside advertising signs in Australia and there has not been a single claim, as far as the industry is aware, of a digital sign being blamed for a crash.

Based on traffic crash risk management principles however, the criteria where digital signs should be considered with greater scrutiny are:

- Locations that are highly unusual in their configuration complexity, or
- Locations that are inherently unsafe anyway, based on crash records.

The proposed sign location does not meet either of the above criteria and is considered to be a very low risk to driver distraction, based on the summary of the research.

5. TRAFFIC SAFETY ASSESSMENT

5.1 Key Assumptions

The assessment of the proposed digital sign was undertaken on the basis that:

- The existing static landscape sign at the subject site will be replaced by a digital LED portrait sign
- The dimensions of the proposed sign will be almost identical with the dimensions of the existing sign despite the change in format
- The proposed digital sign will have the same orientation as the existing static sign
- No significant change is proposed to the structure that will support the digital screen (i.e. existing pole will be upgraded and remain in its current form and function)
- The display of content will be static for a minimum dwell time of 25 seconds with a transition time of no more than 0.1 seconds based on the *Signage Guidelines* criteria
- Illumination/lighting levels for the digital sign will comply with the *Signage Guidelines* and maintain lighting levels to match the surrounding environment at the site.

5.2 Site Inspections

Site inspections were undertaken on Tuesday, 3 May 2022 during day and night-time hours (around 1:00pm and 7:30pm respectively). The weather was clear and traffic conditions were moderate on both occasions. In-vehicle video recordings were taken for further analysis and for use in compiling photo montages of the driver's perspective on the approaches to the site.

The photo montages can be found in **Appendix B**.

5.3 Review of Crash Data

Crash data for the relevant section of the M4 was obtained from Transport for NSW and used to assess the crash history in proximity to the subject site. The most recent five years of crash data at the time of the data request was for 2016-2020. Crashes involving vehicles travelling in the direction of and in view of the site were used for the assessment. The viewing area of the proposed digital sign is from approximately 350m south-east along the M4.

As per Rule 287 (3) of the Australian Road Rules, crashes are only recorded if they are reported to the police and when one of the following occurs:

- Any person is killed or injured
- Drivers involved in the crash do not exchange particulars
- When a vehicle involved in the crash is towed away.

The crash data was provided in the following degree categories:

- **Fatal –** a crash in which at least one person was killed
- **Serious injury –** a crash involving at least one person identified in a police report and matched to a health record indicating a hospital stay due to injuries sustained in a crash, or is identified as an iCare (Lifetime Care) participant AND no one was killed in the crash
- **Moderate injury –** a crash involving at least one person identified in a police report who is matched to a health record that indicates that they were treated at an emergency department but were not admitted for a hospital stay, or is matched to a CTP claim indicating a moderate or higher injury AND no one was killed or seriously injured

- **Minor/Other injury –** a crash involving at least one person identified as an injury in a police report who is not matched to a health record that indicates the level of injury severity, or is matched to a minor injury CTP claim AND no one was killed, seriously injured or moderately injured
- **Non-casualty (towaway) –** a crash in which no one was killed or injured but at least one motor vehicle was towed away.

The crash data was mapped using GIS software and is presented in **Appendix C** along with a detailed record list. The crash maps are presented in terms of degree and type (road user movement describing the first impact of the crash), with a degree summary provided in Table 5.1.

Table 5.1: Crash Degree Summary on Approach to the Site (2016-2020)

Year	Crash Degree					Total
	Fatal	Serious Injury	Moderate Injury	Minor/Other Injury	Non-casualty (towaway)	
*2016**	*-*	*-*	*1*	*3*	*-*	*4*
*Jan-Jun 2017**	*-*	*1*	*1*	*3*	*3*	*8*
Jul-Dec 2017	-	-	1	-	1	2
2018	-	-	1	-	-	1
2019	-	-	-	-	-	-
2020	-	-	-	-	1	1
Total post upgrade	**-**	**1**	**2**	**-**	**2**	**4**

**During WestConnex widening works.*

The crashes that occurred during, or prior to the upgrade works in this location are not relevant for consideration. Key findings from the remaining reported crashes between July 2017 and December 2020 include that:

- No fatalities were reported
- There have been a total of only 4 crashes in 3.5 years.

Since completion of the WestConnex works in July 2017, the data highlights that this is not an inherently unsafe location when considering the high traffic volumes and speed limit through this area. Furthermore, the analysis of the crash records suggests no relationship of these crashes to the existing static billboard.

5.4 Approach Sightline Assessments

5.4.1 Description of Approaches

The westbound approach in proximity to the sign is described in Table 5.2.

Table 5.2: Approach Attributes – M4 westbound

Attribute	Details
Posted speed limit	90km/h (variable)
Decision points within view of the site	There are no decision points within view of the sign
Approach arrangement	4 uninterrupted lanes (lanes 1 to 4), separated evenly between two grade-separated carriageways
Sight length	From approximately 350m south-east of the sign although the sign could only realistically be recognised from about 200m away. At this distance, the sign would appear at the windscreen at a size of 4cm high x 2.5cm wide
Minimum duration of visibility	15s at free-flow speed

5.4.2 Driver Sightline Assessment

Process

In-vehicle observations were undertaken to assess the subject site considering key decision points and the influence on or from traffic control devices. An assessment of still images taken from the driver's perspective with a windscreen-mounted camera is presented in the following section. It should be noted that the assessment was undertaken based on a standard passenger car and as such a driver's eye height may vary for larger and smaller vehicles.

The premise of the assessment is to ensure that the proposed location of the digital sign maintains a driver's sightline to traffic control devices and is not located as such that it may be confused with or confuse the interpretation of these traffic control devices.

The driver's cognitive load specific to the driving environment on approach to the proposed sign has also been considered. Typically, locations where digital signs could have a greater influence crash risk are locations where rapid, complex, multi-factor decision making is required.

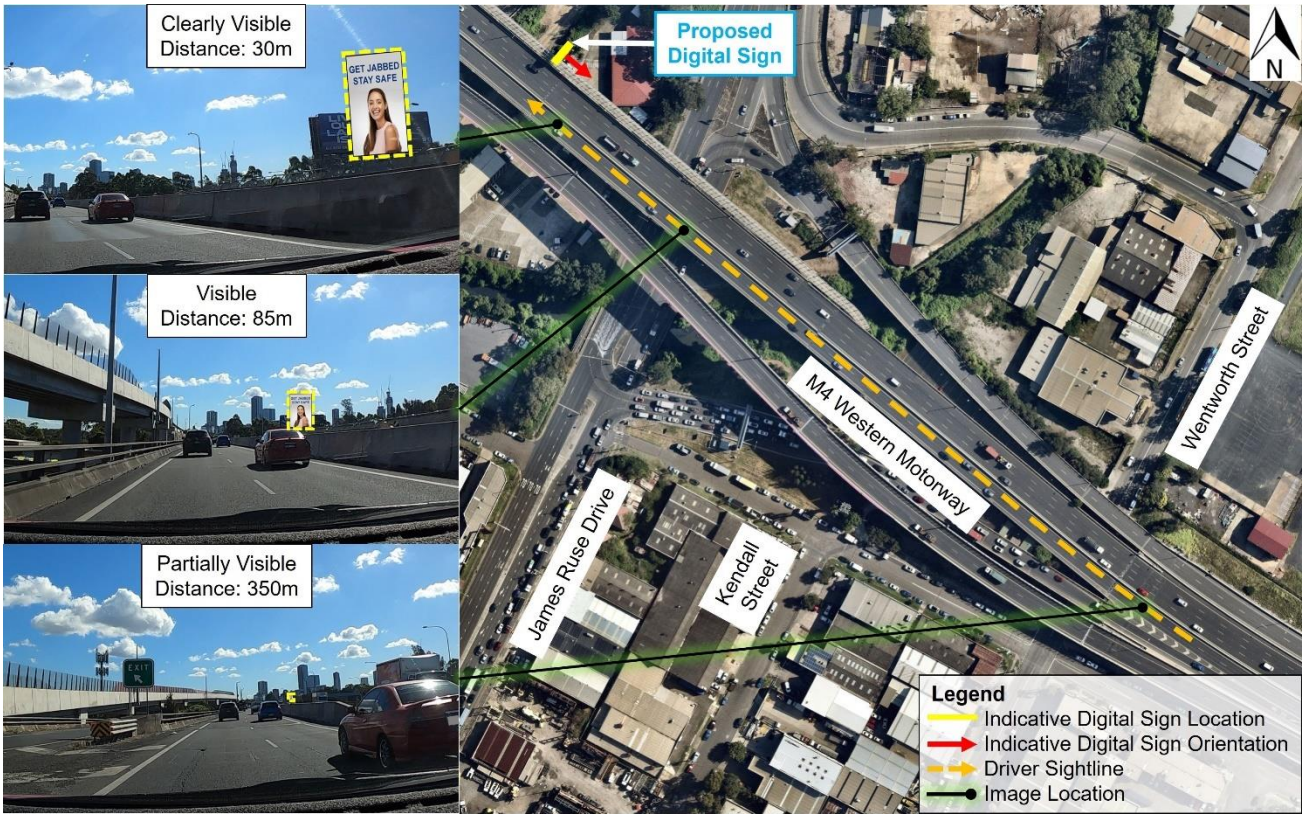
M4 Westbound

The westbound approach along the M4 is predominantly straight and flat towards the sign. The M4 westbound is split in this location with the 'upper carriageway' containing lanes 1 and 2 and the 'lower carriageway' containing lanes 3 and 4.

It is unlikely that drivers in lanes 1 and 2 on the upper carriageway would recognise the sign, unless perhaps they were in a truck. The retaining wall to the right of lane 2 (which is at a car driver's eye height) means that a car driver would not have a sightline to the proposed sign. A truck driver might have a view line to the sign, but it is highly unlikely that a truck driver on this elevated roadway would not be focused on the lanes ahead even if they occasionally glanced peripherally, as all drivers do.

On the lower carriageway from lanes 3 and 4, the digital sign content would be recognisable from about 200m away. Given that the sign is directly in the forward view, when glancing at it, drivers would still recognise changing lanes or braking ahead of them as movement, light and colour changes and react as they would have in the current situation. Despite the 90km/h (variable) speed limit, there is no complex, rapid decision making required by drivers within glance-view of the proposed sign.

The in-vehicle sightlines from the M4 westbound towards the sign is shown in Figure 5.1. This driving environment does not impose a high cognitive load on drivers as there are few decisions to make and plenty of time in which to make them.



[1]*Distances measured in Nearmap.*
[2]*Sign location is indicative, not to scale and for illustration purposes only.*

Figure 5.1: In-vehicle sightlines along the M4 westbound

5.5 Compliance Assessment

5.5.1 Industry and Employment SEPP Schedule 5

The assessment against Industry and Employment SEPP Schedule 5 is provided in Table 5.3. Whilst the criteria are quite generic, the basis for the responses to each criterion is provided next to them.

Table 5.3: Assessment against Industry and Employment SEPP Schedule 5

Section	Criteria	Response
8. Safety	Would the proposal reduce the safety for any public road?	**No –** The proposal would not reduce the safety to the public road because there are no crash-related risks linked to the existing static sign apparent in the crash data.
	Would the proposal reduce the safety for pedestrians or bicyclists?	**No –** No cyclists are allowed on this section of the M4. Additionally, no sightlines for pedestrians and children are obscured by the proposal as the portrait format of the sign will not protrude the existing shared path adjacent to the M4.
	Would the proposal reduce the safety for pedestrians, particularly children, by obscuring sightlines from public areas?	

5.5.2 Transport for NSW Advertising Sign Safety Assessment Matrix

Table 5.4 details the assessment against the Transport for NSW Advertising Sign Safety Assessment Matrix.

Table 5.4: Assessment against the Transport for NSW Advertising Sign Assessment Matrix

Consideration	Response	Risk Rating	Risk Level
A. It obscures a view of an object/vehicle/pedestrian that creates a hazard	The proposed sign will be located above all surrounding objects/vehicles/pedestrians etc.	1	Low
B. Sign positioning relative to travel direction	The proposed sign will be positioned so that only glance appreciation is required. It will be visually prominent westbound.	2	Low
C. It distracts a driver at a critical time	The proposed sign will not be located near any decision points.	1	Low
D. It interferes with the effectiveness and safety of a traffic control device (e.g. traffic signs, traffic signals or other traffic control devices)	The proposed sign is unlikely to noticeably obstruct or interfere with any traffic control devices.	1	Low
E. Sign clutter	No other advertising sign is visible when a driver is in view of the subject sign.	1	Low

5.5.3 Transport Corridor Outdoor Advertising and Signage Guidelines Table 3

Table 5.5 details the assessment against the digital sign criteria in Table 3 of the *Signage Guidelines*.

Table 5.5: Assessment against the Signage Guidelines Digital Sign Criteria

Criteria	Response
a. Each advertisement must be displayed in a completely static manner, without any motion, for the approved dwell time as per criterion (d) below.	Conditions can be imposed by the consent authority to ensure that the sign is completely static for the specified dwell time.
b. Message sequencing designed to make a driver anticipate the next message is prohibited across images presented on a single sign and across a series of signs.	Conditions can be imposed by the consent authority to ensure there is no message sequencing that creates driver anticipation for the next message on the proposed sign or with any other signs.
c. The image must not be capable of being mistaken: i. for a prescribed traffic control device because it has, for example, red, amber or green circles, octagons, crosses or triangles or shapes or patterns that may result in the advertisement being mistaken for a prescribed traffic control device ii. as text providing driving instructions to drivers.	Conditions can be imposed by the consent authority to ensure that sign content, design, imagery and messages neither replicate nor can be mistaken for a prescribed traffic control device or instruction to drivers. For example, advertisements must not instruct drivers to perform an action such as 'Stop'.
d. Dwell times for image display must not be less than: i. 10 seconds for areas where the speed limit is below 80km/h ii. 25 seconds for areas where the speed limit is 80km/h and over.	The minimum allowed dwell time is 25 seconds based on the posted speed limit of 90km/h. Conditions can be imposed by the consent authority to ensure this minimum dwell time.

Criteria	Response
e. The transition time between messages must be no longer than 0.1 seconds, and in the event of image failure, the default image must be a black screen.	Conditions can be imposed by the consent authority to ensure that the sign has a transition time of no more than 0.1 seconds and a black screen in the event of image failure.
f. Luminance levels must comply with the requirements in Section 3 below.	This area is Zone 3 as categorised in Section 3.3 of the *Signage Guidelines*. Acceptable luminance levels for this zone as specified in Table 6 of the *Signage Guidelines* are: no limit (full sun on face of signage), 6000cd/m^2 (daytime), 700cd/m^2 (twilight and inclement weather) and 250cd/m^2 (night-time). Conditions can be imposed by the consent authority specifying maximum allowable luminance levels.
g. The images displayed on the sign must not otherwise unreasonably dazzle or distract drivers without limitation to their colouring or contain flickering or flashing content.	Conditions can be imposed by the consent authority to ensure that the sign's images comply with requirements to not contain flickering or flashing content.
h. The amount of text and information supplied on a sign should be kept to a minimum (e.g. no more than a driver can read at a short glance).	Conditions can be imposed by the consent authority to ensure that minimal text and information is supplied on a sign no more than a driver can read at a short glance.
i. Any sign that is within 250m of a classified road and is visible from a school zone must be switched to a fixed display during school zone hours.	N/A – The sign is not visible from a school zone.
j. Each sign proposal must be assessed on a case-by-case basis including replacement of an existing fixed, scrolling or tri-vision sign with a digital sign, and in the instance of a sign being visible from each direction, both directions for each location must be assessed on their own merits.	All relevant traffic directions have been assessed on their own merits.
k. At any time, including where the speed limit in the area of the sign is changed, if detrimental effect is identified on road safety post installation of a digital sign, TfNSW reserves the right to re-assess the site using an independent TfNSW-accredited road safety auditor. Any safety issues identified by the auditor and options for rectifying the issues are to be discussed between TfNSW and the sign owner and operator.	Noted.
l. Sign spacing should limit drivers' view to a single sign at any given time with a distance of no less than 150m between signs in any one corridor. Exemptions for low speed, high pedestrian zones or CBD zones will be assessed by TfNSW as part of their concurrence role.	No other sign is visible less than 150m.

Criteria	Response
m. Signs greater than or equal to 20sqm must obtain TfNSW concurrence and must ensure the following minimum vertical clearances; i. 2.5m from lowest point of the sign above the road surface if located outside the clear zone ii. 5.5m from lowest point of the sign above the road surface if located within the clear zone (including shoulders and traffic lanes) or the deflection zone of a safety barrier if a safety barrier is installed. If attached to road infrastructure (such as an overpass), the sign must be located so that no portion of the advertising sign is lower than the minimum vertical clearance under the overpass or supporting structure at the corresponding location.	Under Section 4.13(2) of the *Environmental Planning and Assessment Act 1979*, development to be determined by the Minister does not require TfNSW concurrence. Instead, the Minister is only required to consult with TfNSW.
n. An electronic log of a sign's operational activity must be maintained by the operator for the duration of the development consent and be available to the consent authority and/or TfNSW to allow a review of the sign's activity in case of a complaint.	Conditions can be imposed by the consent authority to ensure that an electronic log is kept for the duration of the consent and be available to the consent authority and/or TfNSW for review in case of a complaint.
o. A road safety check which focuses on the effects of the placement and operation of all signs over 20sqm must be carried out in accordance with Part 3 of the TfNSW Guidelines for Road Safety Audit Practices after a 12 month period of operation but within 18 months of the signs installation. The road safety check must be carried out by an independent TfNSW-accredited road safety auditor who did not contribute to the original application documentation. A copy of the report is to be provided to TfNSW and any safety concerns identified by the auditor relating to the operation or installation of the sign must be rectified by the applicant. In cases where the applicant is the TfNSW, the report is to be provided to the Department of Planning and Environment as well.	Conditions can be imposed by the consent authority for a road safety check to be carried out after 12 months but within 18 months of the sign's installation.

6. WESTCONNEX COMMENTS

WestConnex provided comments on the proposal. Bitzios Consulting's responses to the comments are provided in Table 6.1.

Table 6.1: Responses to WestConnex Comments

Comment	Response
The WB James Ruse Drive exit and ramp queues have been an issue under pre-covid traffic and this will increase as traffic returns and with general traffic growth across the network. The typical traffic conditions during the PM Peak westbound are also typically congested with stop-start traffic. The addition of a further distraction for drivers on either outbound viaduct is a real safety concern.	The decision point for the diverge movement to the James Ruse Drive westbound off-ramp is over 800m back from the sign, at which point the sign is unrecognisable. From the upper or lower decks of the M4, there is practically nothing to see outside of the vehicle, apart from the road ahead. The anti-gawking screen to the left of lane 1 and the retaining wall to the right of lane 2 obscure the driver's view to any objects or movement outside of the roadway and the driver's eyeline is 'funnelled' straight ahead. There are no on-ramps or off-ramps and no directional signs. In terms of out-of-vehicle events and associated cognitive load, it is practically zero. The proposition that a driver would stare at a digital sign and in so doing would not see brake lights ahead, or rapid slowing vehicles ahead is not plausible because drivers do not stare at digital signs and because all light and movement changes are in the forward field of view.

7. CONCLUSIONS

The key conclusions from the traffic safety assessment of the conversion of an existing static landscape advertising sign to a digital LED portrait advertising sign on the northern side of the M4 Western Motorway (M4) east of the former Carlingford Railway Line in Rosehill are summarised as follows:

- The proposed sign is consistent with the existing sign in terms of size, location and orientation, with the only change being converting from a static landscape sign to a digital portrait sign and a changing display at fixed time intervals
- The dimensions of the proposed sign will be almost identical with the dimensions of the existing sign despite the change in format, with an overall visual screen size of 42.40m^2
- The proposed digital sign will not obstruct or interfere with the view of or restrict sight distances to any traffic control devices, vehicles, pedestrians or cyclists given its location on the M4. Additionally, no sightlines for pedestrians and children will be obscured as the portrait format of the sign will not protrude the existing shared path adjacent to the M4
- The proposed digital sign is not expected to reduce the safety of any traffic, pedestrians or cyclist movements given its location. It will be located within a driver's ordinary field of view when approaching from the south-east and a glance to the sign will still permit co-incident recognition of vehicle, pedestrian and cyclist movements in the forward view which means that rapid multi-factor decision making is not required
- A review of available five years of crash data within 350m of the site showed that while there were 17 reported crashes between 2016-2020, 12 occurred up to June 2017 which would have been affected by the WestConnex construction works. Since operation of WestConnex in July 2017, the data does not identify an unusually high or inherently high crash risk on approach to the site that would not deem the proposed location unsuitable, considering that the M4 is a high-volume, high-speed road
- The proposed sign complies with the requirements of the Industry and Employment SEPP and Transport for NSW Advertising Sign Safety Assessment Matrix in terms of obscurity, positioning and sign clutter
- The proposed digital sign should be conditioned to comply with the requirements of the *Signage Guidelines* in terms of display and operational requirements, including:
  - Message displays remaining static
  - Sequencing of displays or messaging
  - Images not being mistaken for a traffic control device
  - Minimum dwell time
  - Transition of displays
  - Luminance levels
  - The use of flickering, flashing or moving content
  - Quantity/size of text used on message displays
  - A re-assessment of the digital sign should any detrimental effects on road safety be identified post-installation
  - Maintaining a log of the sign's activity
  - A road safety check after 12 months but within 18 months of the sign's installation.

Given the above conclusions, the digital sign should be approved as proposed.

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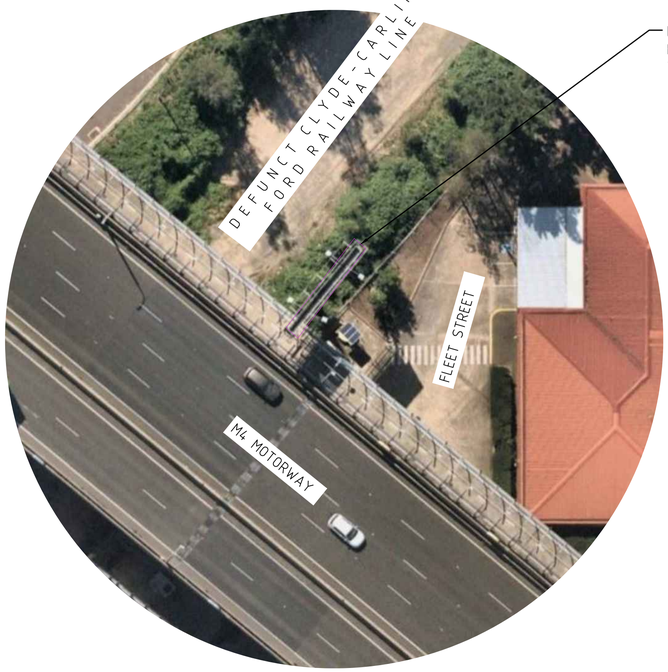
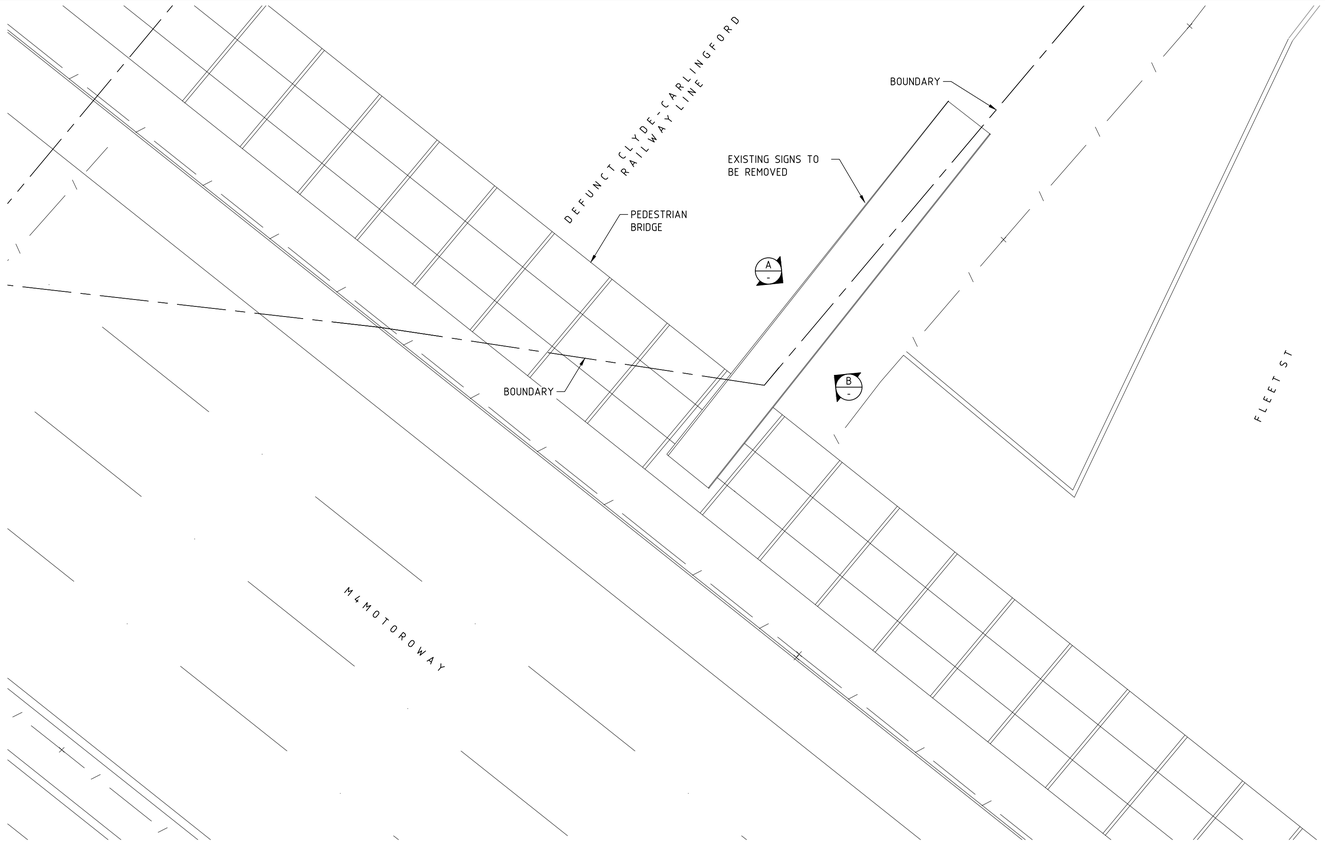
Appendix A: Proposed Development Plan



LOCATION OF EXISTING FRONT LIT SIGNS TO BE REMOVED

N

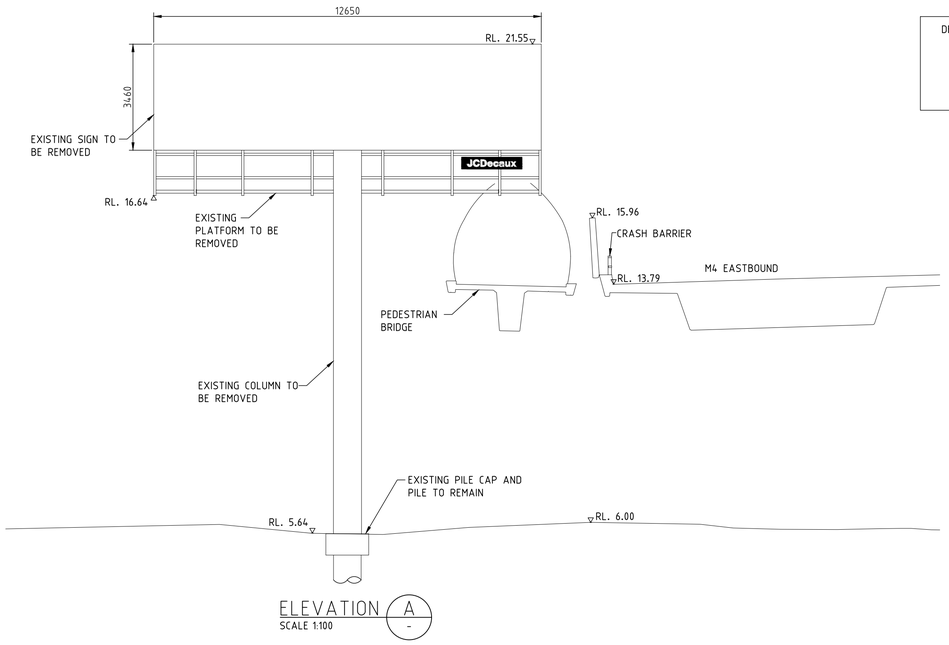
AERIAL PHOTO
NTS



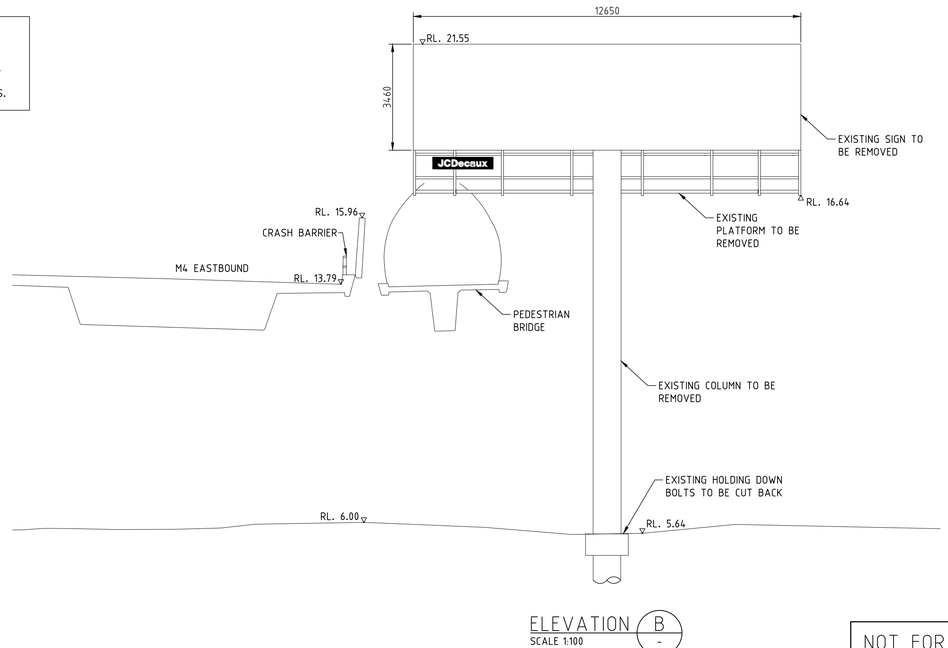
SITE PLAN
SCALE 1:100

DEMOLITION PROCEDURE FOR EXISTING SIGN

1. STOP ACCESS TO FOOTBRIDGE.
2. REMOVE THE SIGN FRAME AND HORIZONTAL TUBE BY CRANE.
3. REMOVE COLUMN BY CRANE.
4. CUT BACK AND GRIND FLUSH EXISTING HOLDING DOWN BOLTS.



ELEVATION A
SCALE 1:100



ELEVATION B
SCALE 1:100

NOT FOR CONSTRUCTION

ISS	DATE	COMMENT
A	19/05/22	ISSUED FOR APPROVAL
B	25/10/22	ISSUED FOR APPROVAL

Dennis Bunt Consulting Engineers Pty Ltd
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P.O. Box 652, Forestville, NSW 2087
Ph: 02 9451 3455 Fax: 02 9451 3466
Email: info@dbce.com.au
ABN 23 039 013 724

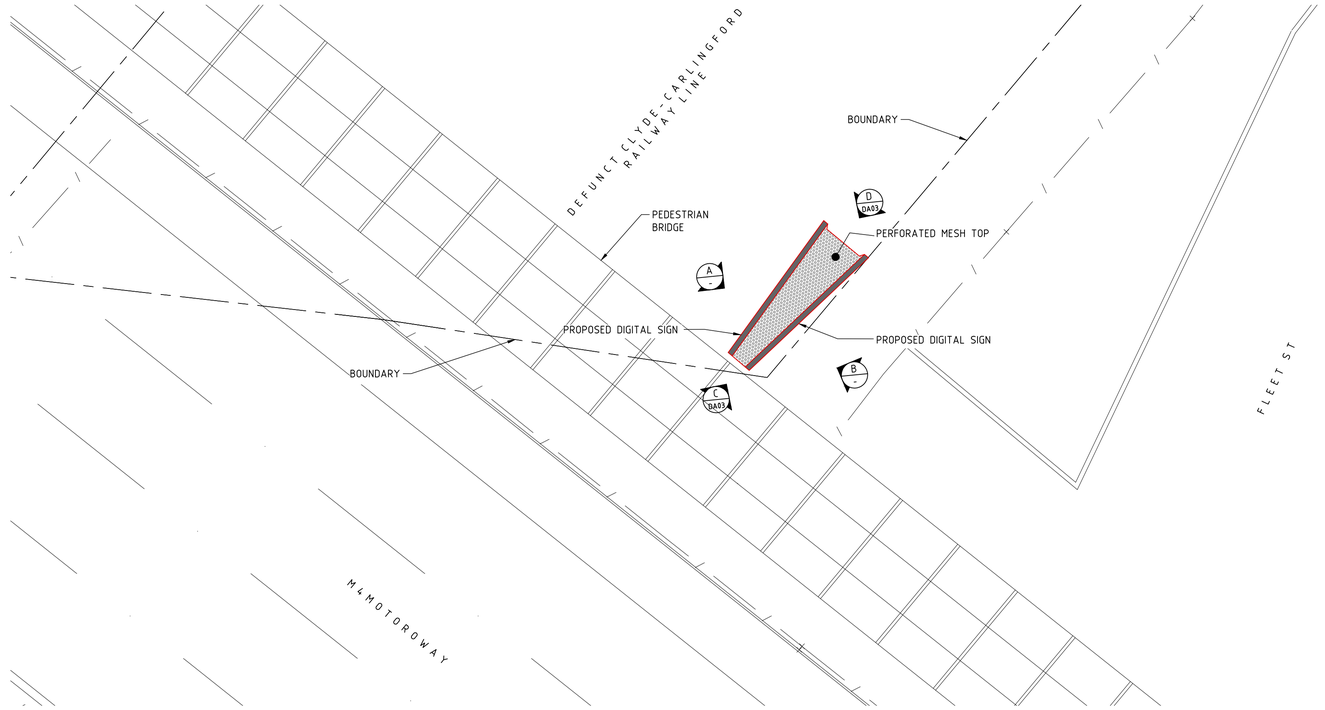
CLIENT: JCDecaux

PROJECT: M4 MOTORWAY, ROSEHILL DIGITAL PORTRAIT

TITLE: EXISTING SIGN GENERAL ARRANGEMENT & SITE PLAN

DRAWN A.T	DESIGN J.L	DATE: MAY 22
JOB NO: 22036		DWG NO: DA01
SCALE @ A1: AS SHOWN		REV: B

AERIAL PHOTO
NTS



SITE PLAN
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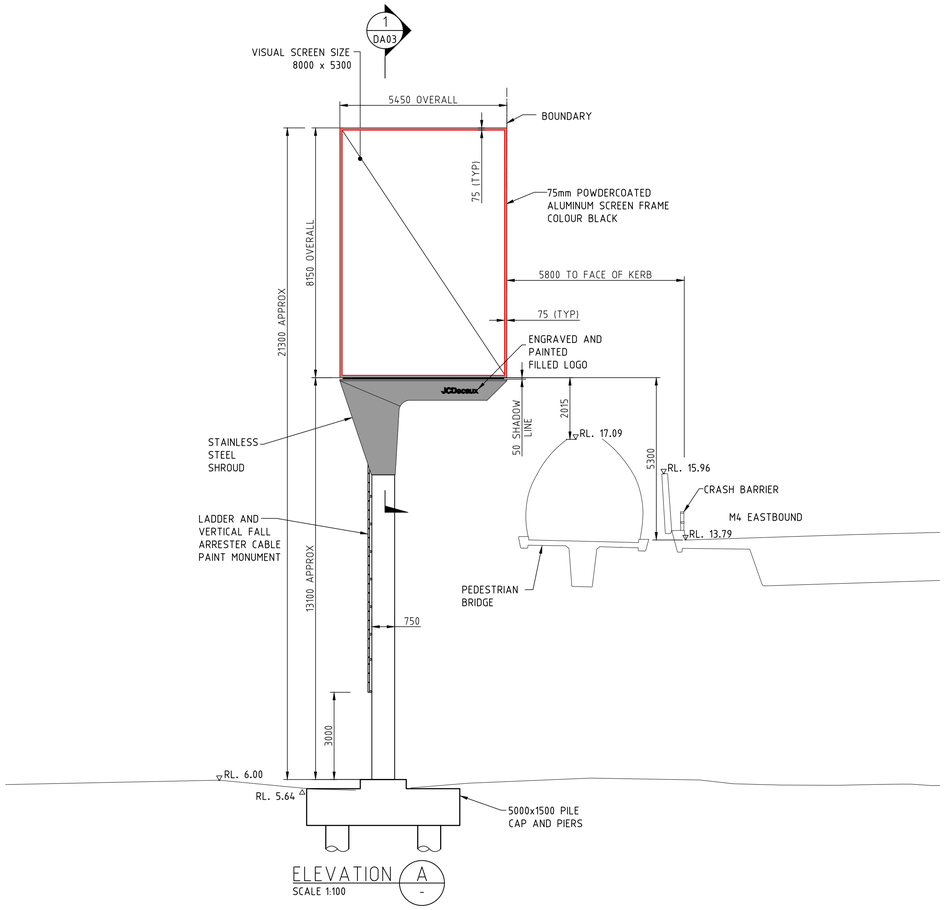

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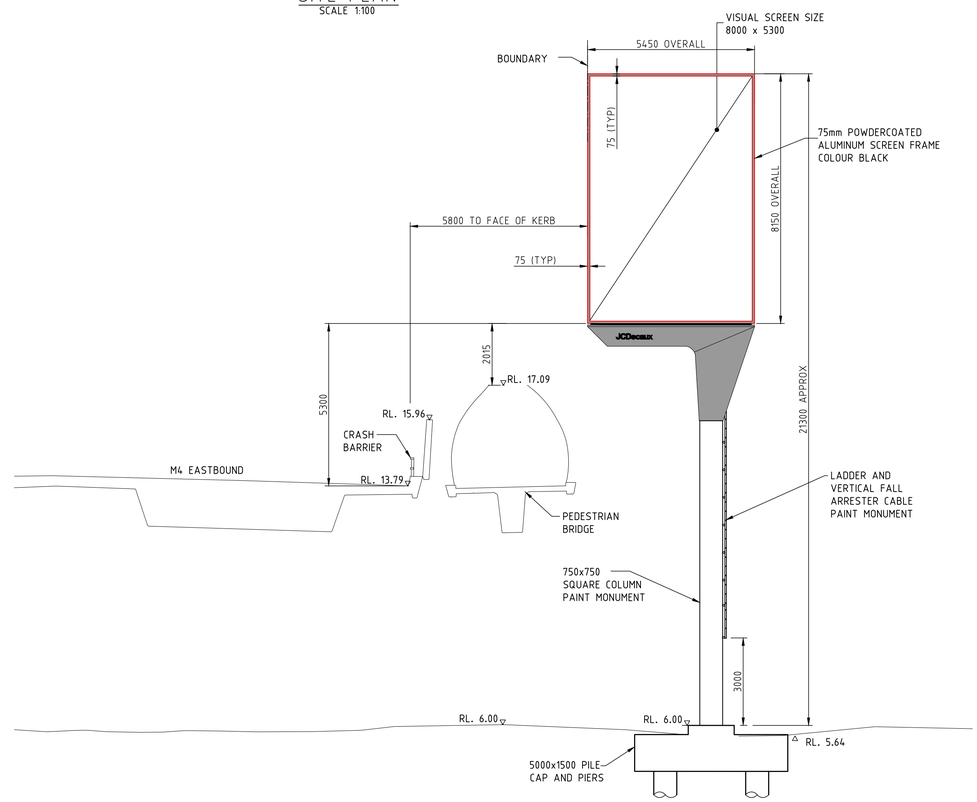

ELEVATION B
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NOT FOR CONSTRUCTION

ISS	DATE	COMMENT
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B	24/05/22	ISSUED FOR APPROVAL
C	29/06/22	ISSUED FOR APPROVAL
D	30/09/22	ISSUED FOR APPROVAL
E	25/10/22	ISSUED FOR APPROVAL
F	03/11/22	ISSUED FOR APPROVAL

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Email: info@dbce.com.au
ABN 23 039 013 724

CLIENT: JCDecaux

PROJECT: M4 MOTORWAY, ROSEHILL DIGITAL PORTRAIT

TITLE: PROPOSED DIGITAL SIGN GENERAL ARRANGEMENT & SITE PLAN

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JOB NO: 22036		DWG NO: DA02
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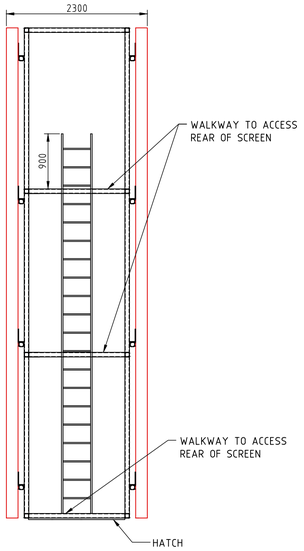

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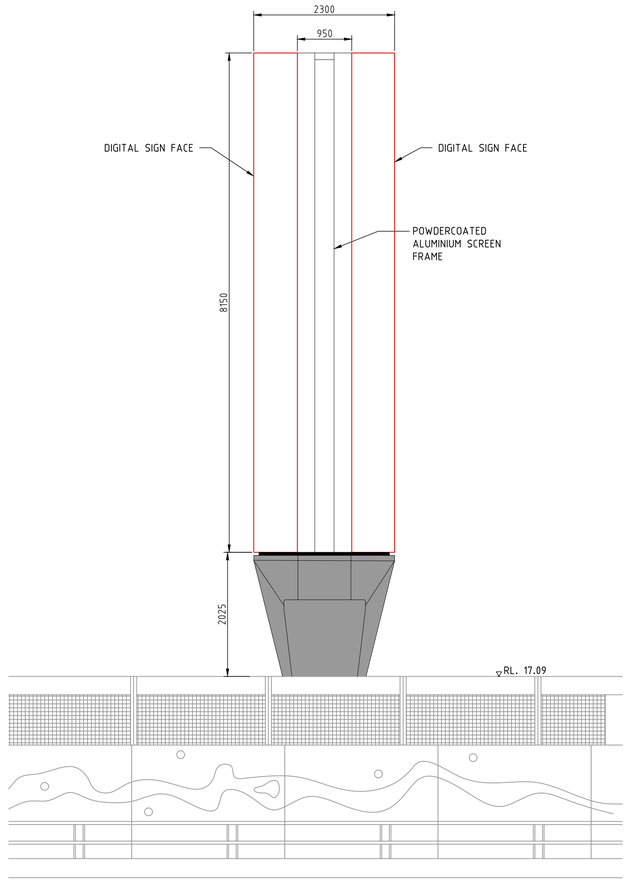

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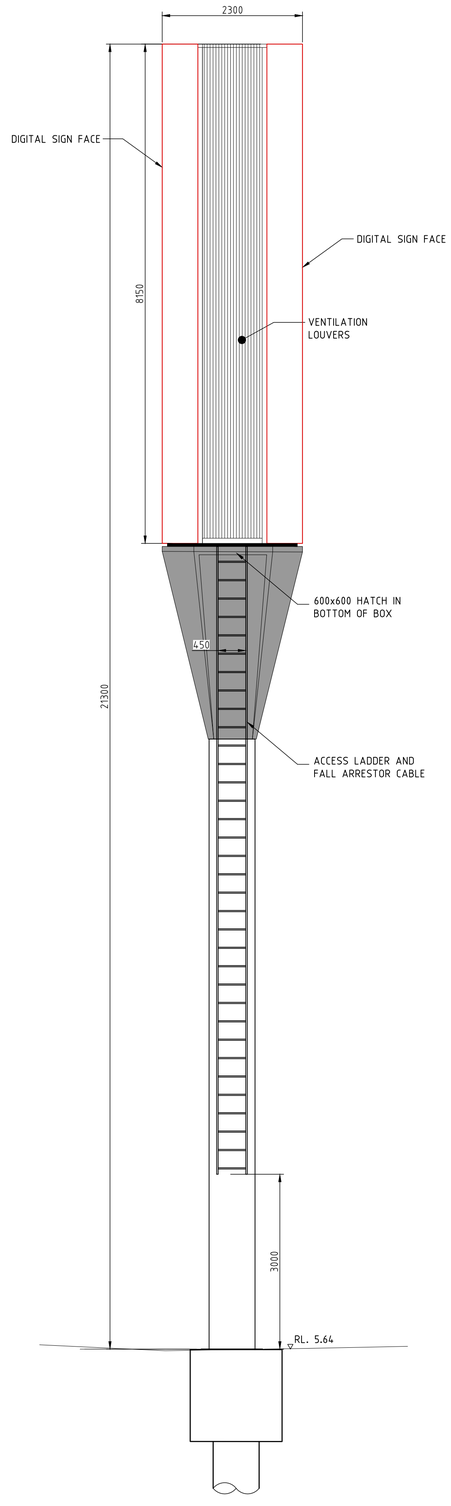

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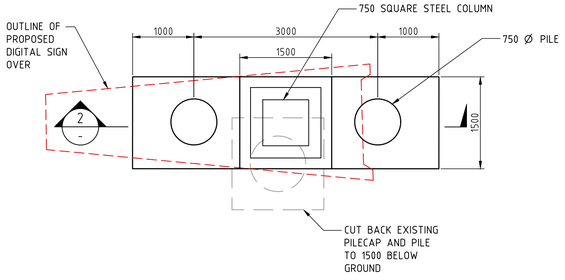
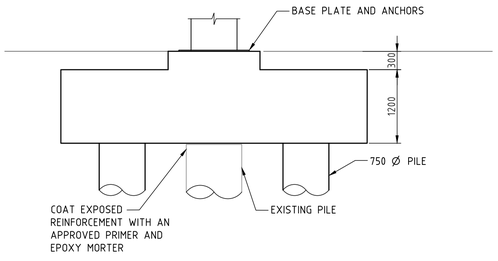


PROPOSED FOOTING PLAN VIEW
SCALE 1:50



SECTION 2
SCALE 1:50 -

NOT FOR CONSTRUCTION

ISS	DATE	COMMENT
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B	24/05/22	ISSUED FOR APPROVAL
C	30/09/22	ISSUED FOR APPROVAL
D	03/11/22	ISSUED FOR APPROVAL

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Email: info@dbce.com.au
ABN 23 039 013 724

CLIENT: JCDecaux

PROJECT: M4 MOTORWAY, ROSEHILL DIGITAL PORTRAIT

TITLE: PROPOSED DIGITAL SIGN PLAN GENERAL ARRANGEMENT

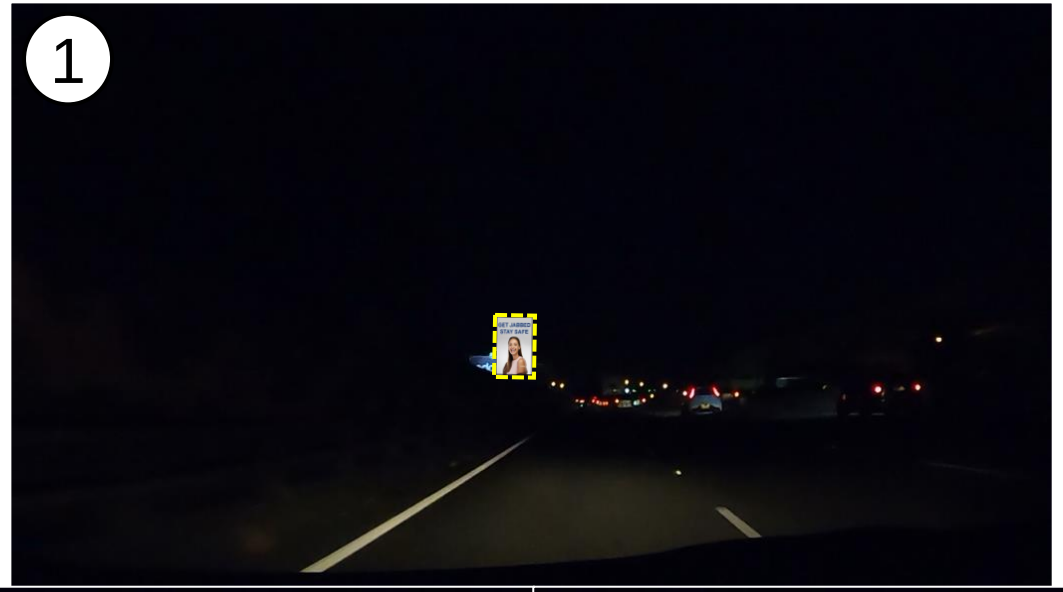
DRAWN A.T	DESIGN J.L	DATE: MAY 22	
JOB NO: 22036		DWG NO: DA03	
SCALE @ A1: AS SHOWN		REV: D	

Appendix B: Photo Montages

1. M4 Western Motorway eastbound approach – Lane 1 (Day)

2. M4 Western Motorway eastbound approach – Lane 4 (Day)

1. M4 Western Motorway eastbound approach – Lane 1 (Night)



2. M4 Western Motorway eastbound approach – Lane 4 (Night)

Appendix C: Crash Data

BITZIOS consulting
traffic engineering + transport planning

Project Title: P5392 Sydney Trains Sites Digital Sign TSAs
Site: M4 Western Motorway inbound, Rosehill
Figure Title: Degree of Crashes – 2016 to 2020
Version: 001
Date: 6/06/2022
File Path: P:\P5392 Sydney Trains Sites Digital Sign TSAs\Technical Work\Mapping\Work Spaces\Rosehill - M4 IB

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Project Title: P5392 Sydney Trains Sites Digital Sign TSAs
Site: M4 Western Motorway inbound, Rosehill
Figure Title: Type of Crashes by RUM Code Group – 2016 to 2020
Version: 001
Date: 6/06/2022
File Path: P:\P5392 Sydney Trains Sites Digital Sign TSAs\Technical Work\Mapping\Work Spaces\Rosehill - M4 IB

Crash ID	Degree of crash - detailed	RUM - code	RUM - description	Year of crash	Month of crash	Day of week of crash	Time of crash	Surface condition	Weather	Natural lighting	Street of crash	Street type	Distance	Direction	Identifying feature	Identifying feature type	Town	Type of location	Latitude	Longitude	Speeding involved in crash	Fatigue involved in crash	Key Traffic Unit direction of travel
1102802	Non-casualty (towaway)	30	Rear end	2016	May	Tuesday	0615	Dry	Unknown	Dawn	WESTERN	EXP	50	West	JAMES RUSE DRIVE	OP	CLYDE	Dual freeway	-33.830491	151.019669	No or unknown	No or unknown	East
1145241	Moderate Injury	30	Rear end	2017	August	Sunday	1310	Dry	Fine	Daylight	WESTERN	EXP	200	East	JAMES RUSE DRIVE	TO	GRANVILLE	Dual freeway	-33.828828	151.017261	No or unknown	No or unknown	East
1247952	Non-casualty (towaway)	39	Other same direction	2020	November	Monday	0745	Dry	Overcast	Daylight	WESTERN	EXP	150	West	JAMES RUSE DRIVE	OP	GRANVILLE	Dual freeway	-33.830020	151.018986	No or unknown	No or unknown	East