



PO Box 97
Red Beach
Auckland, New Zealand

29th July 2026

Bishopp Outdoor Advertising
P.O Box 3391,
Newmarket,
Queensland 4051

Attention: [REDACTED]

Email: [REDACTED]

This copied document is made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach copyright legislation

re: Consent Application - Proposed Digital Billboard Lighting Effects
Location – 154-178 Barwon Heads Road, Belmont VIC 3216

This report is in response to a request by Bishopp Outdoor Advertising to provide further information in response to submissions received by Council and Department of Transport and Planning regarding the potential lighting effects of a proposed double sided digital billboard to be erected on a pole at 154-178 Barwon Heads Road, Belmont Victoria. The lighting related items are primarily the effects from changing digital images with respect to the Victoria Department of Transport and Planning requirements, nearby residences and traffic on the adjacent roadways.

The proposed billboard will be mounted in the southeastern corner of a Timber Trade Centre parking area and will be installed on a pole structure that provides approximately 6m clearance to the underside.

I have experience with preparing lighting effects reports for over 150 digital billboards since their introduction into New Zealand in 2011 and have completed investigations relating to roadways, residents and commercial properties near digital billboards throughout New Zealand and several billboards in various Australian states. I have also tested many of these billboards once completed to provide verification of compliance with lighting-related consent conditions. Digital Billboard lighting requirements have a significant alignment between New Zealand and Australia.

The proposed double-sided 12.48mW x 3.2mH (39.936m²) digital billboard will be arranged in landscape orientation in a vee format and will be located approximately 9.98m to the top overlooking adjacent commercial / industrial buildings and roadways. The proposed double-sided billboard will face generally north and south and will be seen by traffic moving in both directions along Barwon Heads Road and motorists heading west on Breakwater Road.

The billboard was initially proposed to operate 24/7 due to the digital nature of the screen, however the billboard operator has since indicated they are open to limiting nighttime operation by turning the billboard off between curfew hours of 11.00pm to 6.00am on the following day.

Site Property: Lot 2 PS 705828
Site Zoning: Industrial 1 Zone (IN1Z)

Barwon Heads Road has three lane traffic heading south and five lanes heading north adjacent to the billboard location in addition to four lanes heading west on Breakwater Road. The billboard will be seen by traffic heading in both directions on Barwon Heads Road and by motorists heading west on Breakwater Road, however motorists heading east on Breakwater Road may have limited views of the billboard closer to the traffic lights.

The speed limit on the roadway is restricted to 60km/h.

The proposed digital billboard will be located facing the intersection of Barwon Heads Road and Breakwater Road located approximately 85m away where there are traffic signals and controlled pedestrian crossings. The traffic light-controlled intersection is located approximately 120m away from waiting motorists heading south on Barwon Heads Road.

There are no residential buildings in close proximity to the site; however, there are residential properties on Park Street and Merrilyn Street, some with limited elevated views towards the unlit back of the proposed vee-oriented billboards. The billboard location and orientation mean that occupants of nearby commercial buildings and players on the cricket oval may be able to see the billboard. The nearest commercial building that has windows facing the billboard is located approximately 117m away from the proposed billboard and the calculated obtrusive effects are very low.

Specific billboard location, size, orientation and mounting height information is included in separate documentation provided by Bishopp Outdoor Advertising and Stantec for this site.

In summary, the proposed double-sided pole mounted digital billboard will be 12.48m wide x 3.2m high oriented in landscape vee format. The highest portion of the billboard face will be mounted approximately 9.88m above ground level. There will also be a small, illuminated panel along the bottom edge of the billboard oriented in landscape format for a Bishopp logo and a 100mm black border to frame the screen.

Clarification has been requested on the potential for adverse lighting effects from the proposed billboard with changing images on users of the adjacent roadway and nearby building occupants including recent submitters from residential properties.

Documentation

Documentation used in preparing this report comprises: -

1. Bishopp locality drawings and images dated 16th June 2026
2. Results from live luminance and spill light tests at many similar billboards in New Zealand over the last 13 years
3. Reference to OMA Model Advertising Devices Code - Victoria
4. Reference to AS / NZS 4282: 2023 Control of the obtrusive effects of outdoor lighting
5. Reference to City of Greater Geelong - Belmont Planning Scheme 52.05 Signs requirements
6. Reference to Department of Transport and Planning document Ref: PPR 51606/26-A dated 23rd July 2026

I have referred to acceptable luminous intensity limits of external lighting for pre-curfew and curfew situations contained in the joint Australian and New Zealand Standard applicable to outdoor illuminated surfaces, being AS / NZS 4282: 2023 Control of the obtrusive effects of outdoor lighting.

For the purposes of this billboard location, based on AS / NZS 4282, curfew is the nighttime period between 2300 hours and 0600 hours on the following day.

Reference has also been made to the City of Greater Geelong Planning Scheme Signs Ordinance 52.05 and State-wide provisions relating to advertising signage for relevant lighting requirements. The proposed billboard falls into Category 2 for Industrial 1 areas requiring a permit.

An objective of Ordinance 52.05 Signs is to ensure that signs do not cause loss of amenity or adversely affect the natural or built environment or safety, appearance or efficiency of a road.

52.05-6 – Signs with a display of 18 square meters or more

An application must be accompanied by the following information, as appropriate:

- A description of the existing character of the area including built form and landscapes.
- The location of any other signs over 18m², or scrolling, electronic or animated signs within 200 meters of the site.
- Any existing identifiable advertising theme in the area.
- Photo montages or streetscape perspective of the proposed sign.
- Level of illumination including:
 - Lux level for any sign on or within 60 meters of a Transport Zone 2, Transport Zone 3, a residential zone or public land zone.
- The dwell and change time for any non-static images.
- The relationship to any significant or prominent views and vistas.

The proposed billboard will be located on private land adjacent to a road and will be mounted on a pole structure in a vee format.

Councils generally also regulate the installation and display of advertising devices (signs) to ensure they have regard to signs that:

- (a) do not create visual clutter, visual dominance, overshadowing, or loss of outlook or view corridors
- (b) do not affect cultural heritage values of a heritage site, item or object
- (c) do not pose a hazard or nuisance for pedestrians, cyclists or motorists
- (d) control lighting impact when illuminated
- (e) do not give the impression of movement

In addition, I have also considered

- (f) the size and position of the billboard
- (g) the intensity of the digital lighting
- (h) the hours of operation of the sign
- (i) the intended purpose of the changing message of the sign
- (j) the proposed dwell time and transition time between the static images, and
- (k) whether the sign is visible from the road and if so the proximity to and impact on an electronic traffic control device.

The following section addresses the above items.

Illuminated LED Billboard

Aspects relating to plan and elevation drawings, photomontage images, size, location, visual effects, traffic, heritage, character of the area, advertising creative content, dominance and traffic safety are outside the scope of this report.

The proposed double-sided digital billboard proposed for 154-178 Barwon Heads Road, Belmont VIC, will be self-illuminated by closely spaced LEDs arranged in a grid pattern and will not comprise backlit neon or boxed fluorescent lighting. The billboard will be oriented between 65 to 75 degrees to the adjacent roadway.

The billboard will have an inbuilt ambient light control system that automatically adjusts the digital luminance (brightness) of creative images in proportion to available ambient light. While the content of successively displayed creative images is outside the scope of this report, it has been found during verification tests on many digital billboards that a correctly calibrated digital billboard using an automated light sensor system does not cause discomfort glare or have any adaptive glare issues. It is also noted that a sometimes-used requirement to ensure that the average luminance of successively displayed images of less than 30% is difficult to monitor, instead it is better to ensure that the brightest portion of each creative image is less than the maximum permitted luminance for each ambient light condition. This requirement originated in an earlier version of AS/NZS 4282 and has now been removed in the current 2023 version.

The proposed digital billboard will use similar equipment and controls that have been used successfully at other sites in Australia by Bishopp Outdoor Advertising in proximity to commercial properties, residential properties, controlled intersections and roadways to ensure glare and spill light are controlled to acceptable limits.

On a bright day, the images will appear similar to a normal static skin type image and will potentially be less bright than the sky visible above the billboard or on adjacent building wall surfaces being illuminated by the sun, due to the natural blue sky or light coloured cloud and bright sunlight that is typical on clear sunny days.

On overcast days, the ambient light control system will automatically dim the billboard appearance to ensure the creative images do not appear too bright, similarly, on bright days or when direct sunlight may fall on the billboard surface during early morning or late afternoon periods in high summer, the sensor will automatically increase luminance to a level that allows images to be easily read.

At night, the billboard luminance of the brightest colour (white) will be adjusted to a luminance level that is no more than 150 cd/m² to ensure glare effects are less than minor, noting the dark sky above the billboard will be the dominate feature at night. Note that the 150 cd/m² nighttime limit has been determined due to the dark skyline that will be visible above the billboard for motorists travelling along Barwon Heads Road at night as opposed to the brighter luminance value of 350 cd/m² as recommended in AS / NZS 4282: 2023 Table 3.4 for an environmental zone of A4.

I have completed tests on similar billboards showing illuminance values reduced from a maximum of 25 lux when viewed at a distance of 5m immediately in front of a billboard at night, to a maximum of 0.9 lux when viewed from a distance of 28m using the same light coloured (white) image. This decrease in illuminance will mean occupants in nearby commercial buildings located along Breakwater Road and Barwon Heads Road will not notice the lighting effects given the mounting height and viewing angle and will not be obtrusive to passing motorists or cyclists. Illuminance directly below the billboard will be approximately 0.8 lux.

Spill light and luminous intensity will zero for residential properties behind the billboard on Park Street and Merrilyn Street due to the distances involved. The nearest residence is located approximately 127m away and there will be partial screening from existing commercial buildings between the residence and the unlit back of the billboard.

Images displayed on the proposed billboard will be static, will not incorporate flashes, movement, animation, smoke or any other dynamic effects. Image dwell duration is typically set at a minimum of 10 seconds however longer dwell time are sometimes required. An image transition time of 0.5 seconds creates a soft transition change that is barely noticeable unless an observer is looking directly at the billboard when the image changes. If the transition time is 0.1 seconds, the image change would appear more like a flash or flicker and could be distracting for motorists, sportsmen and nearby building occupants. The Department of Transport and Planning require a Condition that includes a requirement for any change to the colours or graphical content of the sign/s must occur within a period of 0.1 seconds or less to the satisfaction of the Head, Transport for Victoria.

The digital billboards at this location will be programmed to achieve an image transition time of 0.1 seconds and a dwell time of 30 seconds.

Billboard luminance will be limited to maximum values for both day and nighttime operation. Luminance is defined as "the physical quantity corresponding to the brightness of a surface (e.g. a light source, luminaire

or reflecting material such as the road surface) when viewed from a specified direction. SI Unit: candela per square metre (cd/m^2), it is also referred to as “Nits”.

Illuminance is defined as the measure of the total amount of light falling on the surface, this is also called incident light or luminous flux per unit area. It is quantified in [lux](#) (lx) where one lux equals one lumen per square meter (lumen/m^2).

Obtrusive light is defined as “spill light which, because of quantitative or directional attributes, gives rise to annoyance, discomfort, distraction, or a reduction in the ability to see essential information such as transport signals”.

The proposed day and night limits are less than those recommended in the Australian OMA Model Advertising Devices Code for Victoria and the Department of Transport and Planning where the recommendations are to limit luminance to $6,000 \text{ cd/m}^2$ during the day and 350 cd/m^2 at night.

Billboard Location

The proposed billboard will be located approximately 120m from motorists waiting at the intersection of Barwon Heads Road and Breakwater Road. Visibility for motorists will not be affected by the proposed billboard.

The existing ambient light level on Barwon Heads Road and Breakwater Road will be reasonably high at night as is typical of a commercial / industrial area adjacent to a highway. Typical ambient light in this type of environment would be 15 to 20 lux based on the proximity of high intensity streetlights in the centre traffic island and on both sides of the roadway near the billboard location.

Results of live tests during the hours of darkness on similar LED billboards have shown that with appropriate commissioning and setup adjustments, the recorded luminance is generally no more than 135 cd/m^2 at night and up to $5,000 \text{ cd/m}^2$ during the day particularly if direct sunlight is falling on the billboard and depending on ambient light levels. Nighttime luminance could be as low as $40\text{-}60 \text{ cd/m}^2$ depending on the creative image being displayed and still be readable in the high brightness nighttime ambient light conditions. As a comparison, the sky viewed above the billboard could be over $6,000 \text{ cd/m}^2$ on a cloudy day.

As noted above, the proposed digital billboard will contain an automated ambient light brightness control system to ensure the luminance of the LED screen will not appear too bright and will adequately control lighting overspill at night, given its location with respect to the road boundary, mounting height on a pole structure, neighbouring commercial properties, and the billboard orientation with respect to the adjacent roadways.

Spill light tests at a similar billboard location indicated a full white image produced less than 1 lux at a distance of 28m directly in front of and centered on the billboard. The nearest commercial window is approximately 117m away and is below the centre of the billboard. Occupants at this distance and location will be able to view the billboard and the surrounding streetlights will provide a high brightness ambient light environment at night, therefore any spill light from the billboard will be negligible and will not be discernable given the high ambient light at this locality at night. Spill light in daytime conditions will not be of concern given ambient light from sunlight will be significantly higher than spill light from a billboard.

The proposed billboard location will also be visible to passing motorists, cyclists, eRideable users and pedestrians travelling in both directions along Barwon Heads Road and a westerly direction on Breakwater Road. The traffic signals at the intersection of Barwon Heads Road are approximately 50m away from the billboard location therefore I do not foresee any confusion for motorists and other roadway users in the area.

Spill Light & Glare

AS / NZS 4282: 2023 “Control of the obtrusive effects from outdoor lighting” in its foreword, acknowledges that the determination of when spill light becomes obtrusive to others is difficult since both physiological and

psychological effects are involved. The purpose of the Standard is to provide a means of providing passive recipients of spill light relief from it being excessively obtrusive as applicable to most recipients.

The Standard does not attempt to eliminate all obtrusive effects but instead provides limits for relevant light technical parameters that will be acceptable to most recipients.

AS / NZS 4282: 2023 also states in the foreword and scope that the Standard does not apply to environmental impacts (including any visual intrusion) caused by the daytime appearance of outdoor lighting systems.

From my experience at many digital billboard sites, daytime illuminance and luminance measured on and at adjacent painted vertical surfaces can be significantly higher than that measured on a digital billboard surface. Daylight is a natural light source from the sun and varies by location, atmospheric conditions, time of day as well as when and where the values are measured.

AS / NZS 4282: 2023 Section 3 states *“The indicators of potential obtrusive effects identified in Section 2.3 relate to light technical parameters specified in Tables 3.2 to 3.4. These limits are applicable to residents, transport system users, environmentally sensitive areas, and astronomical observatories. Although these limiting values are intended to control the obtrusive effects, they will not necessarily ensure that a conforming installation will receive no adverse reaction from those affected by the spill light”*.

Spill lighting will not be an issue during the day due to high natural daylight illuminance being potentially as high as 150,000 lux on a bright day. Any light spill from the digital images on the billboard will be negligible and will not be noticed during the day.

AS / NZS 4382: 2023 Table 3.1 provides a guide to various environmental zones. The ambient light condition at 154-178 Barwon Heads Road is best described as “medium” based on the locality being in a commercial / industrial urban growth zone with street lighting and other commercial based area lighting operating at night.

Spill light from a light source such as a billboard is typically limited to 5 lux at night by Table 3.2 in AS / NZS 4282: 2023 for zone A3 areas noting the proposed billboard is not located within 100m of a residential window. The proposed billboard spill light on nearby commercial buildings will be significantly less than this value. Calculations indicate the maximum spill light on an adjacent building will be 0.5 lux.

The digital billboard will include dark-coloured baffles above each LED to mitigate upward waste light and “image washout” effects from direct sunlight, resulting in an Upward Light Ratio (ULR) of not more than 45%.

AS / NZS 4282: 2023 includes Table 3.4 to provide maximum average luminance limits for nighttime billboard operation. The nighttime lighting conditions at 154-178 Barwon Heads Road is best categorized as “Medium District Brightness” as defined in the Department of Transport Requirements and Guidelines for Illuminated Outdoor Advertising Signage, as being equivalent to Environmental Zone “A3” of AS / NZS 4282: 2023. Environmental zone A3 would apply to the proposed billboard noting the area is in an area with industrial and commercial activities and does not have residential areas abundantly to the site.

Luminance limits outlined in AS / NZS 4282: 2023 are appropriate for nighttime situations using LED technology in residential and commercial areas with a medium mounting height and sky as the background as indicated in the control of the obtrusive effects of outdoor lighting standard given that in practice, the actual nighttime luminance will be less than the recommended value in the above standard.

The maximum average luminance limit recommendation is stated in Table 3.4 as 350 cd/m² at night. The proposed digital billboard will be illuminated potentially up to 24 hours per day, 7 days a week and will comply with this nighttime limit, however the proposal is to limit nighttime luminance to 150 cd/m² and to turn the billboard off between 11.0pm and 6.0am on the following day for the reasons stated above.

Tests and commissioning adjustments on installed digital billboards have resulted in acceptable readability with the AS / NZS 4282: 2023 limit at night of 150 cd/m² set as a maximum, however in most conditions the

luminance of the proposed digital billboard at night will be more like 135 cd/m² and could be as low as 40-60 cd/m² as described earlier. The operator will monitor the LED luminance at commissioning to provide an optimum nighttime luminance value that is less than 150 cd/m² to enable the billboard content to be read effectively.

Glare from a bright light source can be distracting to passing motorists and cyclists. Threshold Increment is limited by AS / NZS 4282 Table 3.2 to 20% based on a default adaption level of 1 cd/m² as a means of ensuring glare will not be an issue. Calculations attached show that the proposed billboard will have a very low luminous intensity of 0 cd from the nearest commercial building window.

Threshold increment will be negligible for motorists passing the billboard with a maximum value of 0.08%. Threshold increment was calculated for motorists approaching the billboard from the north and south on Barwon Heads Road and from the east on Breakwater Road. Calculations represent the perspective of motorists in a typical vehicle with the calculation grid at 1.5m above ground level to replicate the eye level of a typical motorist and using a windscreen cut off angle of 20 degrees.

I am not aware of any discussion regarding a condition to “freeze” image displays at certain times of the night. and In my opinion the inclusion of this requirement as a condition is not warranted and has no mitigating effect on lighting or an observer’s appreciation of the nighttime environment. It is, however, relevant that a faulty billboard should revert to a frozen black screen until the fault can be repaired.

There are many examples of digital billboards located near roadways, commercial buildings and intersections in Australia. I am not aware of any requirement that prohibits billboards that are directly visible from any site having traffic lights nearby.

My finding from assessing many similar digital billboard sites is that the proposed billboard will not flicker or flash and would instead have a soft transition of 0.5 seconds between creative images. The proposed low nighttime luminance levels will also assist in reducing the prominence of the billboard when viewed from nearby properties and from the roadway, particularly with a dark night sky being viewed above the billboard location,

Road Safety

While road safety is outside the scope of lighting design, it is acknowledged that lighting effects such as excessive glare and spill light can contribute to road safety issues.

The Outdoor Media Association (OMA) have prepared an Advertising Devices Code for Victoria. Chapter 5 in the OMA document outlines the results of research undertaken by OMA on driver behavior in the presence of advertising signage. These tests were prepared using eye tracking glasses and a vehicle recording device. The research found that:

- Drivers spend the same amount of time (average 78%) with their eyes on the road whether in the presence of digital, static or on-premise signs.
- There is no significant difference in the length of time people look (fixation duration) at digital signage compared with static signage.
- Drivers maintain the same safe average vehicle headway (distance between themselves and car in front) in the presence of all signage types.
- Over 99% of all glances towards advertising signage were less than 750 milliseconds, which is the minimum time needed by any driver to perceive and react to an unexpected event.

OMA performance criteria P10 states that digital advertising devices do not create a road safety risk or hazard when deemed to comply with requirements are followed such as A14 minimum dwell time, A15 transition time, and A17 regarding content that is designed so that it cannot be mistaken for a traffic control device. This billboard proposal meets these requirements.

Residential Amenity

Residential amenity is a subjective topic and can differ between each resident and can often become emotive. Of note, the proposed vee-oriented billboard will not face any residential property, therefore there will not be a direct view of images. Users of nearby open spaces may be able to see the billboard depending on their location.

Submitters located at 13 Park Street and in residences along Merralyn Street will not be able to see the images from their yard in normal situations because the unlit rear portion of the billboard will be facing in their direction. There may be occasions during periods of fog where residents may be able to see effects of images reflecting off water particles around the billboard face.

I have also relied on the findings of previous tests I have completed inside a motel room located immediately next to an operating digital billboard to evaluate the impact of billboard luminance and spill light on occupants immediately adjacent to an operating digital billboard with changing images during the day and at night.

Residential occupants along Merralyn Street and Park Street are at least 127m away from the rear of the proposed billboard and are not considered to be in proximity to the proposed billboard.

The outcome of tests taken inside a motel room located immediately adjacent to a digital billboard that operated 24/7 concluded that the effects from images on the internal wall surfaces were less than from a television operating in a dimly lit room. The only time the billboard was noticeable in this location was when an observer looked directly at the billboard. In my opinion if residents go about their normal activities in their residences or in their yards located along Merralyn Street and Park Street, it would be very unlikely that they would notice images changing or be drawn to the coloured creative images even with blinds open given the distance to the proposed digital billboard and there are no direct views of digital images.

I also consider that it would be unlikely sleeping would be affected, noting that the bedrooms will likely have blinds of some form for privacy given the proximity of neighbours, and the existing ambient light levels at this locality.

There have been concerns from residents regarding operation of digital billboards at night and potential effects on sleep patterns and circadian rhythm as well as open space users during the day. Reports available online are written more about personal use of device screens being used immediately before bed, and the impact of high blue content from a device screen, and how that may impact sleep patterns. Digital billboards have varying creative images made of multiple colours and hues.

Digital billboards are also dimmed significantly at night, down to 2 or 3% of maximum brightness and they are not located within 1 meter of a person's face like a personal device can be. I also note that the operators revised proposals to turn the billboard off between 11.00pm and 6.00am on the following day.

I consider the amenity effects of these residents will not be affected.

Conclusions

Based on the above information, I consider the operation of the proposed digital billboard at 154-178 Barwon Heads Road in Belmont will have less than minor effects on motorists using nearby roadways and residents in the residential zone some distance away. The term "less than minor" is based on adverse effects that are discernable day-to-day effects but are too small to adversely affect other persons.

In terms of luminance associated with the proposed LED billboard, the effects of automatically adjusting brightness during daylight hours is suitable having regard to the changing environmental characteristics that prevail, such as the possibility of direct morning sunlight and overcast days and will provide an appropriate level of luminance for the effective readability of the billboards in varying daylight conditions such as on dull overcast days.

Nighttime luminance limits will in practice be no higher than the proposed limit of 150 cd/m². Tests and commissioning adjustments on other installed digital billboards have resulted in acceptable readability with 150 cd/m² set as a maximum, however in most conditions the luminance of the proposed digital billboard will be more like 135 cd/m² and could be as low as 40-60 cd/m² depending on image colour.

There are no residential buildings in close proximity to the proposed billboard that will be able to easily see the billboard. Calculations have been prepared to show the expected spill light on the nearby commercial building at 4/6 Breakwater Road for completeness. Spill light and luminance limits will be met with less than 5 lux spill light and very low luminous intensity. There is the potential for colour shifts from the billboard to be noticeable at night, however it would be very unlikely that building occupants would notice images changing or be drawn to the coloured creative images if they are going about their normal business, even if close by, given the high district brightness and proximity to a busy road.

In my opinion, there is no viable lighting related reason to direct the billboard operator to “freeze” images at night to mitigate perceived lighting effects. Image luminance levels at night will be low and transitions between images will be set at 0.1 seconds as required by the Department of Transport and Planning.

Unless an observer was looking directly at the billboard, it would be unlikely that an occupant in a nearby building or a motorist on Barwon Heads Road would notice an image change.

The proposed billboard will meet the lighting objectives outlined in the City of Greater Geelong Signs Planning Scheme Ordinance 52.05 Signs requirements, in particular the noted criteria regarding glare, adjustable intensity and light spillage of lighting, sensitivity of design with respect to the nearby buildings, and the proposed image dwell and transition times.

I support the proposed digital billboard application, noting the following lighting related items:

- Daytime luminance limit of 3,250 cd/m² (Nits) increasing to 5,000 cd/m² if in direct sunlight
- Nighttime luminance limit of 150 cd/m² (Nits)
- Dawn and dusk luminance limit of 600 cd/m² (Nits)
- Image dwell time of 30 seconds
- Image transition of 0.1 seconds
- Images will be static, and not incorporate flashes, video, emissions, or other dynamic effects
- The luminance level of the LED display during daylight hours will vary to be consistent with the level of ambient light and ensure that the LED display is not significantly brighter than ambient light level and is only illuminated to the extent necessary to ensure that it is legible. To achieve this, the brightness of the LED's will be automatically controlled with an in-built detector/sensor.
- The billboard will not cause glare or dazzle motorists due to an automated brightness control system adjusting screen appearance in changing light conditions
- In the event of any malfunction of the LED's or the control system, the screen will be designed to turn off or default to a blank screen until the malfunction has been repaired.
- The billboard is located in a medium district brightness A3 environment.
- Threshold increment limit of 20% will be met for passing motorists, pedestrians, eRidable users and cyclists.
- There will not be any confusion between traffic light signals and billboard images since they will be significantly larger than and less bright than any traffic related sign or light.
- The billboard will not include any retro-reflective material or high gloss finishes in the frame or mounting system.
- The proposed billboard will not affect the amenity of residential properties to the west of the billboard.

In essence, the double-sided pole mounted digital billboard that is proposed to be located at 154-178 Barwon Heads Road, Belmont, will be designed to be both engaging and responsibly designed, with lighting effects carefully managed to minimize negative impacts and maximize its benefits for businesses and the wider community.

In summary, just because you can see a digital billboard with changing images, does not make it obtrusive.

I consider the lighting aspects as identified above to be a complying activity in terms of light spill and glare and will not impact the safety of passing motorists, eRideable users, pedestrians or cyclists.

Prepared on behalf of
Kern Consultants Ltd



Obtrusive Light - Compliance Report

AS/NZS 4282:2023, A4 - High District Brightness, Curfew

Filename: EL01 Barwon Heads Road VIC Billboard Rev B

17/07/2026 1:37:41 pm

Illuminance

Maximum Allowable Value: 5 Lux

Calculations Tested (10):

Calculation Label	Test Results	Max. Illum.
ObtrusiveLight 1 Merralyn St_Ill_Seg1	PASS	0.0
ObtrusiveLight 13 Park St_Ill_Seg1	PASS	0.0
ObtrusiveLight 3 Merralyn St_Ill_Seg1	PASS	0.0
ObtrusiveLight 4-6 Breakwater Rd_Ill_Seg1	PASS	0.0
ObtrusiveLight 5 Merralyn St_Ill_Seg1	PASS	0.0
ObtrusiveLight 6 Merralyn St_Ill_Seg1	PASS	0.0
ObtrusiveLight 8 Merralyn St_Ill_Seg1	PASS	0.0
ObtrusiveLight Motorists approaching Lights Barwon Heads Rd_Ill_Seg1	PASS	0.0
ObtrusiveLight Motorists at Lights Barwon Heads Rd_Ill_Seg1	PASS	0.0
ObtrusiveLight Motorists at Lights Breakwater Rd_Ill_Seg1	PASS	0.0

Luminous Intensity (Cd) At Vertical Planes

Maximum Allowable Value: 2500 Cd

Calculations Tested (10):

Calculation Label	Test Results
ObtrusiveLight 1 Merralyn St_Cd_Seg1	PASS
ObtrusiveLight 13 Park St_Cd_Seg1	PASS
ObtrusiveLight 3 Merralyn St_Cd_Seg1	PASS
ObtrusiveLight 4-6 Breakwater Rd_Cd_Seg1	PASS
ObtrusiveLight 5 Merralyn St_Cd_Seg1	PASS
ObtrusiveLight 6 Merralyn St_Cd_Seg1	PASS
ObtrusiveLight 8 Merralyn St_Cd_Seg1	PASS
ObtrusiveLight Motorists approaching Lights Barwon Heads Rd_Cd_Seg1	PASS
ObtrusiveLight Motorists at Lights Barwon Heads Rd_Cd_Seg1	PASS
ObtrusiveLight Motorists at Lights Breakwater Rd_Cd_Seg1	PASS

Threshold Increment (TI)

Maximum Allowable Value: 20 %

Calculations Tested (9):

Calculation Label	Adaptation Luminance	Test Results
Barwon Heads Rd TI Lane 1 Heading North	10	PASS
Barwon Heads Rd TI Lane 1 Heading South	10	PASS
Barwon Heads Rd TI Lane 2 Heading South	10	PASS
Barwon Heads Rd TI Lane 3 Heading South	10	PASS
Barwon Heads Rd TI Lane 5 Heading North	10	PASS
Breakwater Rd TI Lane 1 Heading West	10	PASS
Breakwater Rd TI Lane 4 Heading West	10	PASS
Breakwater Rd TI Off Lane 1 Heading South	10	PASS
Breakwater Rd TI Off Lane 2 Heading South	10	PASS

GENERAL NOTES

DESIGNED TO AS/NZS 4242: 2023
LIGHTING ENVIRONMENTAL ZONE A4.

OBTRUSIVE LIGHT CALCULATIONS DO NOT INCLUDE ANY STREET LIGHTS AND DO NOT INCLUDE CAR PARK LIGHTING

LIGHTING CALCULATIONS ARE
SUBJECT TO THE ACCURACIES AND
TOLERANCES IN ACCORDANCE WITH
AS/NZS 3827.1 AND AS/NZS 3827.2.

THESE ACCURACIES & TOLERANCES
INCLUDE VARIANCES IN ROOM
DIMENSIONS AND OBSTRUCTIONS,
SURFACE FINISHES, LUMINAIRE
POSITIONING AND AIMING, AMBIENT
TEMPERATURE, ATMOSPHERIC
CONDITIONS, LUMINAIRE PHOTOMETRY,
LAMP OUTPUT, LIGHTING DESIGN
SOFTWARE, ELECTRICAL SUPPLY AND
INSTRUMENT CALIBRATION.

B	REVISED BILLBOARD LOCATION	RK	17/07/26
A	FOR INFORMATION	RK	16/04/26
Rev	Amendment	Name	Date



49 Pohutukawa Ave, Red Beach 0932,
Auckland
Mobile: 021 302 336

R KERN	14/04/2026
Calculated	Date

Job Title
BISHOPP OUTDOOR
BILLBOARD
154-178 BARWON HEADS
BELMONT 3216

Sheet Title

BILLBOARD EXTERNAL LIGHTING GLARE CALCULATIONS

Project	4151	Calculation ES01
File	Projects\2025\4151\Calcs	
Scale	1:400@ A1	Amendment B

Numeric Summary							
Label	CalcType	Units	Avg	Max	Min	Min/Avg	Min/Max
Barwon Heads Rd TI Lane 1 Heading North	Obtrusive - TI	%	0.0	0.03	0.00	N.A.	0.00
Barwon Heads Rd TI Lane 1 Heading South	Obtrusive - TI	%	0.0	0.00	0.00	N.A.	N.A.
Barwon Heads Rd TI Lane 2 Heading South	Obtrusive - TI	%	0.0	0.00	0.00	N.A.	N.A.
Barwon Heads Rd TI Lane 3 Heading South	Obtrusive - TI	%	0.0	0.00	0.00	N.A.	N.A.
Barwon Heads Rd TI Lane 5 Heading North	Obtrusive - TI	%	0.0	0.01	0.00	N.A.	0.00
Breakwater Rd TI Lane 1 Heading West	Obtrusive - TI	%	0.0	0.00	0.00	N.A.	N.A.
Breakwater Rd TI Lane 4 Heading West	Obtrusive - TI	%	0.0	0.00	0.00	N.A.	N.A.
Breakwater Rd TI Off Lane 1 Heading South	Obtrusive - TI	%	0.0	0.00	0.00	N.A.	N.A.
Breakwater Rd TI Off Lane 2 Heading South	Obtrusive - TI	%	0.0	0.00	0.00	N.A.	N.A.
Calc Horizontal at GL	Illuminance	Lux	0.1	0.8	0.0	0.00	0.00
ObtrusiveLight 1 Merralyn St_Cd_Seg1	Obtrusive - Cd	N.A.	0.0	0	0	N.A.	N.A.
ObtrusiveLight 1 Merralyn St_III_Seg1	Obtrusive - III	Lux	0.0	0.0	0.0	N.A.	N.A.
ObtrusiveLight 13 Park St_Cd_Seg1	Obtrusive - Cd	N.A.	0.0	0	0	N.A.	N.A.
ObtrusiveLight 13 Park St_III_Seg1	Obtrusive - III	Lux	0.0	0.0	0.0	N.A.	N.A.
ObtrusiveLight 3 Merralyn St_Cd_Seg1	Obtrusive - Cd	N.A.	0.0	0	0	N.A.	N.A.
ObtrusiveLight 3 Merralyn St_III_Seg1	Obtrusive - III	Lux	0.0	0.0	0.0	N.A.	N.A.
ObtrusiveLight 4-6 Breakwater Rd_Cd_Seg1	Obtrusive - Cd	N.A.	0.0	0	0	N.A.	N.A.
ObtrusiveLight 4-6 Breakwater Rd_III_Seg1	Obtrusive - III	Lux	0.0	0.0	0.0	N.A.	N.A.
ObtrusiveLight 5 Merralyn St_Cd_Seg1	Obtrusive - Cd	N.A.	0.0	0	0	N.A.	N.A.
ObtrusiveLight 5 Merralyn St_III_Seg1	Obtrusive - III	Lux	0.0	0.0	0.0	N.A.	N.A.
ObtrusiveLight 6 Merralyn St_Cd_Seg1	Obtrusive - Cd	N.A.	0.0	0	0	N.A.	N.A.
ObtrusiveLight 6 Merralyn St_III_Seg1	Obtrusive - III	Lux	0.0	0.0	0.0	N.A.	N.A.
ObtrusiveLight 8 Merralyn St_Cd_Seg1	Obtrusive - Cd	N.A.	0.0	0	0	N.A.	N.A.
ObtrusiveLight 8 Merralyn St_III_Seg1	Obtrusive - III	Lux	0.0	0.0	0.0	N.A.	N.A.
ObtrusiveLight Motorists approaching Lights Barwon Heads Rd_Cd_Seg1	Obtrusive - Cd	N.A.	0.0	0	0	N.A.	N.A.
ObtrusiveLight Motorists approaching Lights Barwon Heads Rd_III_Seg1	Obtrusive - III	Lux	0.0	0.0	0.0	N.A.	N.A.
ObtrusiveLight Motorists at Lights Barwon Heads Rd_Cd_Seg1	Obtrusive - Cd	N.A.	0.0	0	0	N.A.	N.A.
ObtrusiveLight Motorists at Lights Barwon Heads Rd_III_Seg1	Obtrusive - III	Lux	0.0	0.0	0.0	N.A.	N.A.
ObtrusiveLight Motorists at Lights Breakwater Rd_Cd_Seg1	Obtrusive - Cd	N.A.	0.0	0	0	N.A.	N.A.
ObtrusiveLight Motorists at Lights Breakwater Rd_III_Seg1	Obtrusive - III	Lux	0.0	0.0	0.0	N.A.	N.A.

Luminaire Schedule					
Symbol	Qty	Label	Arrangement	LLF	Description
	2	BB	SINGLE	0.160	LED Billboard 12480mm x 3200mm

CITY OF GREATER GEELONG - BELMONT PLANNING REQUIREMENTS FOR
PROPERTY CATEGORY - INDUSTRIAL 1 ZONE (IN1Z)
154-178 BARWON HEADS ROAD - LOT 2 PS 705828
BELMONT VIC 3216

COPY RIGHT

THE DESIGN SHOWN ON THIS DRAWING IS THE COPYRIGHT OF KERN CONSULTANTS LIMITED AND MUST NOT BE REPRODUCED WITHOUT WRITTEN AUTHORITY

GENERAL NOTES

DESIGN IS BASED ON A
DOUBLE SIDED VEE FORMAT
STANDARD 12.48m X 3.2m DIGITAL
BILLBOARD WITH LIGHT
COLOURED IMAGE

DESIGNED TO AS/NZS 4242: 2023
LIGHTING ENVIRONMENTAL ZONE A4.

OBTRUSIVE LIGHT CALCULATIONS DO
NOT INCLUDE ANY STREET LIGHTS
AND DO NOT INCLUDE CAR PARK LIGHTING

LIGHTING CALCULATIONS ARE
SUBJECT TO THE ACCURACIES AND
TOLERANCES IN ACCORDANCE WITH
AS/NZS 3827.1 AND AS/NZS 3827.2.

THESE ACCURACIES & TOLERANCES
INCLUDE VARIANCES IN ROOM
DIMENSIONS AND OBSTRUCTIONS,
SURFACE FINISHES, LUMINAIRE
POSITIONING AND AIMING, AMBIENT
TEMPERATURE, ATMOSPHERIC
CONDITIONS, LUMINAIRE PHOTOMETRY,
LAMP OUTPUT, LIGHTING DESIGN
SOTWARE, ELECTRICAL SUPPLY AND
INSTRUMENT CALIBRATION.

B	REVISED BILLBOARD LOCATION	RK	17/07/26
A	FOR INFORMATION	RK	16/04/26
Rev	Amendment	Name	Date

bishopp

kern

Consultants

PO Box 97, Red Beach 0945,
Auckland
Mobile: 021 302 336

R KERN	14/04/2026
Calculated	Date

Job Title

BISHOPP OUTDOOR
BILLBOARD
154-178 BARWON HEADS
BELMONT 3216

Sheet Title

BILLBOARD EXTERNAL
LIGHTING GLARE
CALCULATION RESULTS

Project	4151	Calculation
File	Projects\2024\4151\Calc	ES02
Scale	N.T.S.	Amendment B