



Lighting Assessment Report

SH1 Rolleston Access Improvements | Package 1 – Roundabout and associated works

Prepared for New Zealand Transport Agency Waka Kotahi
Prepared by Beca Limited

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Executive Summary

The SH1 Rolleston Access Improvements project, being carried out for New Zealand Transport Agency Waka Kotahi (NZTA) is proposing the use of road lighting to illuminate the road way and pedestrian underpasses. Specifically, lighting is proposed at and adjacent to the Roundabout to clearly identify the proposed road infrastructure, to illuminate the road corridor, changes in alignment, road surface markings and kerb locations, as well as to illuminate any stalled or stationary vehicles. Pedestrian underpass and shared path lighting is proposed in specific locations.

A preliminary lighting design has been carried out to enable the assessment of likely effects of the lighting installation.

Luminaires used in the design, and the design itself meet the requirements NZTA M30, and AS/NZS1158 series of standards. Luminaires are generally pole mounted at a height of 14m above ground level, and aimed away from residential units, providing less glare and spill light than might otherwise be observed.

AS/NZS 1158 requires a Threshold Increment (glare control) below 15% and Upward Waste Light Ratio (UWLR) shall not exceed 1%. Because of these factors, and the use of full cut-off luminaires, the effects of glare, unwanted spill light, and upward waste light (that would contribute to sky-glow) on the environment are considered to be less than minor.

Along the majority of the Project, there are buffer distances between the road carriageway and the adjacent properties, and this will assist in mitigating any effect of headlights. The effects from headlights are considered to be less than minor because the vehicles will not generally be moving directly towards residential properties.

Any additional landscape planting proposed between the proposed road corridor and residential properties will offer additional visual barriers that will further reduce the lighting effects.

Should a condition of consent be required to reinforce the district plan requirements, we recommend this is included in the NOR package.

1 Purpose of this Report

This Report has been prepared by Beca Limited (Beca) to inform the Assessment of Environmental Effects (AEE) for one Notice of Requirement (NoR 1) being sought by New Zealand Transport Agency Waka Kotahi (NZTA).

The Project proposes to construct a roundabout at the SH1 Dunns Crossing and Walkers Road intersection and associated works to provide transport upgrades that are necessary to respond to both existing transport deficiencies as well as provide for the forecasted future growth pressures in the area.

This Report will specifically consider the actual and potential construction and operational effects of the Project as it relates to lighting effects and recommendations to mitigate effects.

This report should be read alongside the AEE, which contains further details on the history and context of the Project. The AEE also contains a detailed description of works to be authorised within this NoR, and the typical construction methodologies that will be used to implement this work.

Where a description of an activity is necessary to understand the potential effects, it has been included in this report for clarity.

2 Project Description

Rolleston is one of the fastest growing towns in New Zealand and is experiencing transport pressures to keep the community connected and state highway intersections safe. In addition, there are increasing potential conflicts at road/rail crossings.

The urgent need for investment in the Rolleston transport network has been recognised as a Road of Regional (ROR) significance, with the Rolleston Access Improvements project part of the 'Canterbury Package'.

The project includes a number of safety and efficiency improvements (reduced deaths and serious injuries, greater travel choices and reduced travel times) on State Highway 1 and adjacent local roads in Rolleston. The objectives of the project are to:

- Improve the safety and efficiency of travel along the State Highway,
- Improve safety and accessibility for goods and people travelling between the residential and industrial areas of Rolleston for all transport modes.

Improve safety and accessibility for goods and people travelling to the Rolleston residential and industrial areas from the State Highway. The Project is being delivered in two packages:

- Package 1 - SH1 / Dunns Crossing Road Roundabout and associated works.
- Package 2 - Overpass and balance of the works.

For the purposes of this Report, Package 1 will be discussed.

Package 1 involves the construction of a roundabout and associated works at the SH1, Dunns Crossing and Walkers Roads intersection to support safe and efficient access across the highway and to and from Rolleston.

The associated works include the realignment of Dunns Crossing Road and of Walkers Road to align with the new roundabout, construction of a new cycle/pedestrian subway across the state highway and an upgraded railway level crossing for both vehicles and pedestrians.

The improvements will provide for a safe crossing of the State Highway adjacent to the Walkers Road / Dunns Crossing Road roundabout and better connectivity between the Rolleston residential area the expanding industrial area.

3 Schedule of Standards and District Plan Criteria

3.1 Lighting Standards

In this Report, the following Lighting Standards have been referred to:

- AS/NZS 1158.0.2005 Lighting for Roads and Public Spaces Part 0 - Introduction
- AS/NZS 1158.1.1:2022 Lighting for roads and public spaces, Part 1.1: Vehicular traffic (Category V) lighting — Performance and design requirements
- AS/NZS 1158.3.1:2020 Lighting for Roads and Public Spaces Part 3.1 - Pedestrian Area (Category P) Lighting - Performance and Installation Design Requirements
- AS/NZS 4282:2023 Control of the Obtrusive Effects of Outdoor Lighting
- NZTA Waka Kotahi M30 Lighting Design Guidelines, Edition 1 Amendment 1: 2014

The proposed State Highway and other classified road lighting design and cycleway/walkways, together with luminaire selection, proposed for the Project will conform to the requirements of Road Lighting Standard AS/NZS 1158 series, referred to throughout this report as “the Standard”. The Standard provides for safe vehicle and pedestrian movement and the timely identification of objects and pedestrians, to the motorist’s eye, while travelling at speed during the darkness hours. Under the Standard, road lighting is defined into two types:

- Type V primarily for Vehicular movement; and
- Type P for Pedestrians movement

NZTA M30 (referred to throughout this report as “the Guideline” is based upon the Standard, and contains further refinement to technical lighting parameters relevant in particular to NZTA roads.

3.1.1 Road Lighting Category Selection

Using the selection criteria in AS/NZS1158.1.1:2022, Table 3.1, the provided AADT data, the Rightlight cat V calculator and professional judgement the Package 1 road carriageway and surrounds have been designed meet the requirements of AS/NZS1158.1.1:2022 subcategories V3 and V4.

For clarity, the lighting subcategories that are applicable to specific road locations are shown below in Table 3-1:

Table 3-1: Road Categories

Location	Subcategory
Walkers Road	V4
Main South Rd (west of RAB)	V3
Main South Rd (east of RAB)	V3
Dunns Crossing Road	V4
Main South Rd (north of RAB)	V3

3.1.2 Level Crossing Lighting

The road lighting at the Road / Railway Crossing in Package 1 has been designed to meet the requirements of AS/NZS1158.1.1:2022 Part 4.6.

3.1.3 Pedestrian Lighting Category Selection

Using the selection criteria in AS/NZS1158.3.1:2020, Table 2.4 and professional judgement the Package 1 road pedestrian route has been based on the requirements of subcategory PE1.

3.2 Selwyn District Plan

As a designated State Highway, the Project is not required to comply with the Partially Operative Selwyn District Plan (POSDP or the District Plan). However, when preparing this Report, the District Plan requirements and the lighting standards that are referred to in the District Plan, have been considered as these provide a guide to acceptable lighting in the Project area, proposed designation extent and the surrounding context.

As per Rule LIGHT-R2 of the POSDP, artificial outdoor lighting for roads and public pedestrian accessways and cycleways is a permitted activity in all zones, providing the standards set out in LIGHT-REQ4 Sky Glow - Roads and Public Pedestrian Accessways and Cycleways are met.

LIGHT-REQ-4 is outlined below:

1. All artificial outdoor lighting for roads and public pedestrian accessways and cycleways shall:
 - a. Utilise flat glass luminaires; and
 - b. Be directed downward and shielded from above to ensure that all light shines below the horizontal; and
 - c. Have a maximum uplight value of U0; and
 - d. Have the ability to connect to control systems to enable lighting to be turned off or dimmed.

Additionally, NZTA is also required to comply with Section 153(3) of the Local Government Act 2002 which states that the Crown is bound by the bylaws if non-compliance by the Crown would be “likely to have an adverse effect on public health or safety”.

It is considered reasonable that the Project, inclusive of temporary construction lighting, comply with District Plan standards, as far as practicable, as these provide for lighting appropriate to the surrounding receiving environment.

In this case, the receiving environment is comprised of existing roading infrastructure, railway reserve, residential development, rural land and Rolleston Mens Prison.

3.3 Summary

The indicative lighting design carried out for Package 1 indicated that the requirements of the Standard and the Guideline, and the POSDP are able to be met.

4 Proposed Lighting

4.1 General

Lighting is proposed to be installed within and adjacent to the existing and proposed State Highway corridor, throughout the underpass, and adjacent to the shared path.

The shared path and underpass lighting assists pedestrians and cyclists to orientate themselves, detect potential hazards and discourage crime as per Crime Prevention through Environmental Design (CPTED) principles.

Lighting is required at the roundabout to clearly identify the proposed infrastructure, to illuminate the road corridor, changes in alignment, road surface markings and kerb locations, as well as to illuminate any stalled or stationary vehicles. The proposed lighting is depicted in Figure 4-1 below:

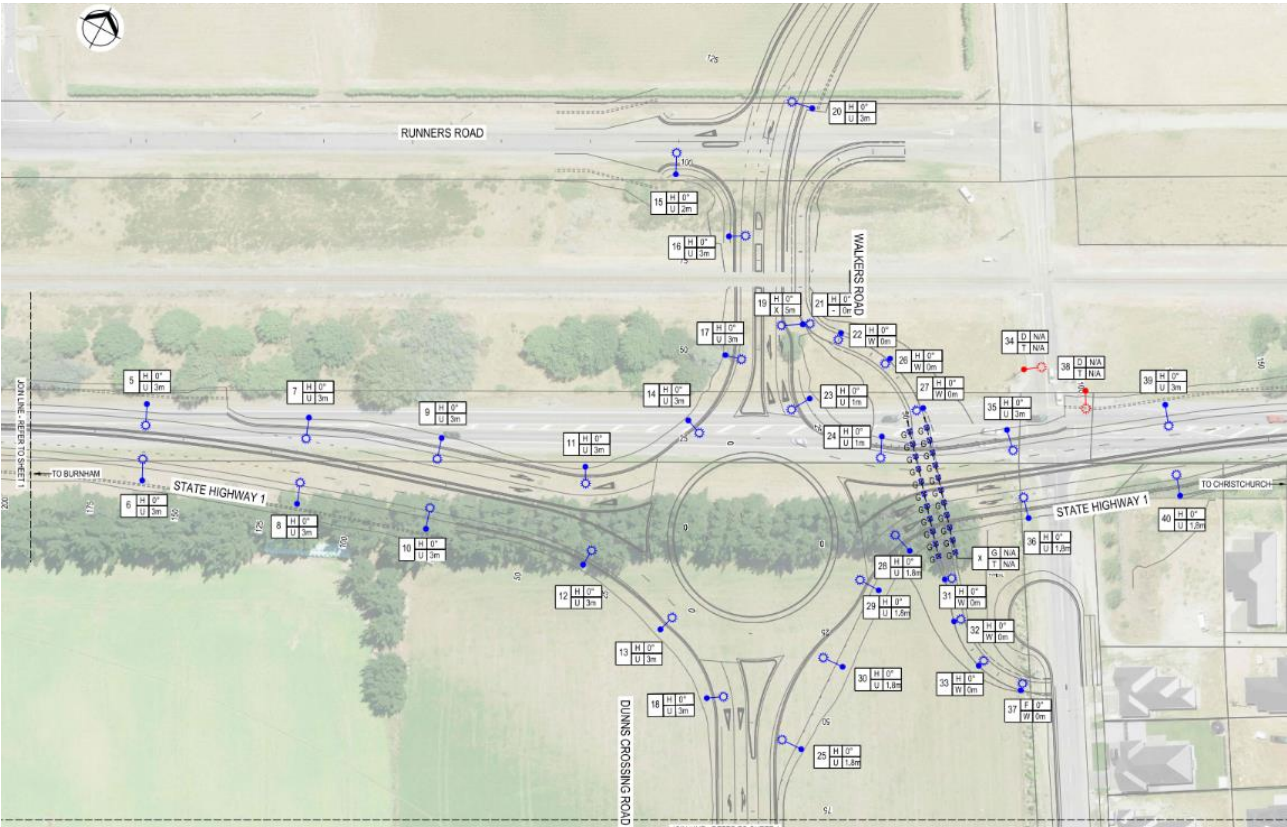


Figure 4-1: Lighting Layout Plan DWG No: 3338703-10-CU-3512

4.2 Road Luminance and Illuminance Levels

The indicative lighting design shows that the technical lighting requirements can be met for the road carriageway. Tables indicating compliance with the required light technical parameters (LTP’s) are included in Beca drawings 3338703-10-CU sheets 3521 – 3524.

4.3 Pedestrian Illuminance Levels

The indicative lighting design shows that the technical lighting requirements can be met for the pedestrian pathway/underpass. Tables indicating the degree of compliance with the required LTP’s are included in Beca drawings 3338703-10-CU sheet 3522.

5 Assessment of Effects

5.1 Existing Environment

The existing roads within the Project area of Package 1 are not currently illuminated, with the exception of two obsolete luminaires marking the SH1 intersection. The current intersection does not include any formal provision for pedestrians and cyclists, as such, there is no existing lighting for pedestrian and/or cyclists.

5.2 Proposed Environment

The proposed changes to the existing road layout at the intersection result in a need for road lighting and lighting associated with the underpass and shared path. The altered intersections and associated specified locations (such as the traffic islands) have been illuminated. Comparatively straight sections of road outside of the Project area are not proposed to be illuminated as part of this Project.

Dark adaptation lighting has been included on the SH1 exits from the intersection where vehicle speeds are anticipated to be higher. Unlit pedestrian / cycleway underpasses are known to increase a fear of crime. An initial CPTED review has been completed identifying the subway as a high-risk area for antisocial behaviour, suggested mitigation measures included providing lighting to the subway and its approaches as well as a high-quality, well-maintained environment to deter this behaviour. A CPTED report is scheduled to be completed following the preliminary design phase and mitigation measures incorporated into the design prior to the detailed design phase.

The Pedestrian underpass and associated access routes have been illuminated as required by the Standard and the Guidelines. The preliminary lighting design has been reviewed and achieve the CPTED and Safety in Design (SID) objectives identified to date.

5.3 Potential Permanent Adverse Effects

Although the rules contained within the POSDP are not strictly applicable to designations, the standards provide guidance on the levels of light that are acceptable to nearby sensitive receivers.

There are four main lighting effects that have the potential for varying degrees of intrusiveness to users of vehicles and to any residents adjacent to the proposed new lighting;

- Spill lighting
- Glare
- Sky glow (upward light content)
- Headlight sweep.

Spill Lighting

Light spill, which occurs when light extends beyond intended boundaries, can be either intrusive or beneficial depending on the situation. While excessive light spill can disturb residents and transportation users, it is sometimes necessary for safety, particularly on State Highways, arterial roads and underpasses to illuminate users of footpaths and shared paths for vehicular road users.

The indicative lighting design shows that it is possible to limit spill light to the windows of adjacent residential properties. We note that other than for housing, we are not aware of any other sensitive receptors or special ecological environments within the considered proximity.

Tables including detailed reporting of light spill at multiple residential locations have been included in Beca drawings 3338703-10-CU sheets 3532 - 3534. Spill lighting has been calculated using the initial intensity values of the luminaires, to evaluate the worst-case scenario levels of spill lighting.

The modelled results from the indicative lighting design of spill lighting at residential windows are below the permissible limits noted within AS/NZS4282:2023 after curfews.

Our assessment of the lighting effects is that when the requirements of the Standard and the Guideline are met, the spill lighting levels on neighbouring residential properties will be less than minor.

Glare

Glare is the brightness of a luminaire when compared with the brightness of the background against which the luminaire is visible. For example, a road luminaire looks brighter (and has higher glare) when viewed against a dark sky than when viewed in the surroundings of an illuminated urban environment. There are two forms of glare:

- Disabling glare; and
- Discomforting glare.

Disabling glare is of an intensity that it prevents adequate vision for accomplishing a task. Discomforting glare can generally be tolerated, but is a nuisance, as it tends to draw the eye towards the light source.

The light technical parameter used in the Standard and the Guideline is Threshold Increment (TI), which is “a measure of the loss of visibility caused by the disability glare from the road lighting luminaires”.

Specified in the Standard, if the glare is kept below a 15% maximum of Threshold Increment (T.I.) then it is considered that glare is controlled to the driver's eye.

Specified in the Guideline, if glare is kept below a “10% maximum of Threshold Increment (TI) then it is considered that glare is controlled” to the driver's eye.

Glare to residential windows, as a result of road lighting, is treated in response to individual complaints to the Selwyn District Council and can be controlled by the fitting of back or forward shields. Both these measures reduce the amount of light that is seen by the resident, but also can alter the luminaires photometric performance.

The indicative lighting design carried out for Package 1 shows that the TI achieved by the design is well within the limits specified in both the Standard and the Guideline. The compliance table for State Highway 1 included in Beca drawings 3338703-10-CU sheet 3522.

TI is not specifically reported for intersections (it is calculated based on the luminaires placed along a straight road). Luminaires with the same optical distribution as used for the carriageways have also been used throughout the intersections.

The modelled results from the indicative lighting design of glare to road users caused by the road lighting are below the permissible limits within AS/NZS1158.1.1:2022 and the NZTA M30 design guidelines. Given the separation of the road carriageway and therefore the lighting from residential properties, it is our assessment that the glare effects from the road lighting can be controlled to the point where these effects are less than minor.

Skyglow Effect

Sky glow is caused by light being directed upwards into the sky, and/or reflecting directly or indirectly off the road surface and illuminating particles in the atmosphere. While challenging to reduce the effects of reflected light, direct light is addressed by limiting or removing the direct upward component from luminaires. It is important to recognise that sky glow results from the combined effect of thousands of road lights along with the exterior lighting of urban areas (such as residential, commercial and industrial areas).

The lighting proposed in the indicative lighting design meets the requirements of the Standard and the Guidelines, and limits the direct upward spill light to less than 1%.

The potential of Skyglow as a result of the proposed lighting is appropriately controlled, as such, there are considered to be less than minor adverse effects associated with sky glow from this project.

Headlight Sweep

Headlight sweep refers to the movement of a vehicle's headlights as the vehicle approaches, passes, and moves away from a particular point. This sweeping motion of light can momentarily brighten areas not illuminated by fixed lighting, such as the sides of roads or adjacent properties.

It is anticipated that effects from headlights are most likely to affect residential properties when headlights are directed toward a dwelling. Where headlights are visible from passing traffic, with headlights oriented at obscured angles, the effects would be less than if headlights were directed towards residential units. Within the Project area, there are buffer distances between the proposed road and the adjacent residential properties to the east, this will further assist in mitigating the effect of headlights.

It is not anticipated that light from headlights will give rise to adverse effects for owners and occupiers of the residential units on Dunns Crossing Road, adjacent to the Project area. It is worth noting that for the majority of the adjacent Dunns Crossing Road residential units, the proposed road corridor will be setback greater than the existing – albeit at a revised angle.

The separation distance between the Project and residential properties, in conjunction with the circular nature of the roundabout, will minimise light from headlights beyond the proposed SH designation. As such, it is considered that any effects associated with headlight sweep will be less than minor.

Construction Lighting Effects

It is reasonable to expect that any temporary construction/laydown area lighting achieves compliance with the relevant rules with the POSDP as this provides for a lighting environment appropriate to the surrounding receiving environments.

Temporary flood lighting for construction activities, where installed adjacent to residential areas, may require glare and spill light control. This lighting has not yet been designed and will be considered through a Construction Management Plan however it is anticipated that this lighting will be fully compliant with the requirements of POSDP rules for obtrusive light and the relevant clauses of the Australian Standard (AS 4282).

The Contractors working on the Project may be required to use floodlights, either portable or temporary, to assist in the construction process depending on timing. Should these be required, these should be mounted so that they do not cause excessive glare towards residential properties (on Dunns Crossing Road) or towards SH1, Walkers Road, Runners Road, and Dunns Crossing that will be in use by the public. This can be controlled by the careful selection of luminaire type and monitored care of luminaire aiming angles.

Mitigation of adverse effects relating to temporary construction lighting can be undertaken with cut-off luminaires, sunshade cloth screening and through achieving appropriate setbacks from sensitive receivers. Construction lighting is usually relatively transitional and will be reduced with careful location of any on-site offices and equipment in relation to the residential area.

Mitigation of construction lighting effects can be managed through a Construction Environmental Management Plan (CEMP).

Lighting Infrastructure - Types of Luminaires

Street and road luminaires are available in three primary light distribution types: open, semi-cut-off, and fully cut-off (also known as aero-screened). To control glare and spill light in and adjacent to the Project area, fully cut-off luminaires (known as Type 3) are proposed to be used.

The proposed fully cut-off luminaire directs no light above the horizontal plane. The types of luminaires proposed for this Project are on the NZTA Waka Kotahi M30 approved luminaire list.

All luminaires selected achieve the photometric and material requirements of the AS/NZS 1158 Road Lighting Standard.

6 Recommended Mitigation Measures

The modelling of the light effect on the immediate surroundings does not take into account natural land profiles or physical blocking of the emitted light by existing fences, vegetation and trees. All of these have the effect of further reducing spill light and glare to immediately adjacent properties and recognition of this needs to be taken into account in the assessment of effects.

The POSDP notes that the lighting associated with roads is a permitted activity in all zones, providing the standards set out in LIGHT-REQ4 Sky Glow - Roads and Public Pedestrian Accessways and Cycleways are met. Furthermore, this assessment of effects has reviewed the computer modelled lighting effects from an indicative lighting design for this project. Provided the requirements of the Standard (AS/NZS1158, current versions as of 28/7/2024) and the Guideline (NZTA M30, current version as of 28/7/2024) are used to determine the lighting solutions applied, the effects of lighting on road users and adjacent residential property occupiers is considered to be less than minor.

We therefore recommend that in addition to the POSDP, a possible condition of the NOR could seek that the lighting is designed to comply with the current versions of AS/NZS 1158 Lighting for roads and public spaces (the Standard) and NZTA M30 Specification and Guidelines for Road Lighting Design (the Guideline).