

18 Lighting

Overview

This Chapter assesses the potential effects of the proposed lighting associated with the construction and operation of the Project and the measures proposed to avoid, remedy or mitigate those effects. These potential effects are considered to include spill lighting, glare, skyglow and headlight sweep.

Construction yard and activity lighting, while temporary, has the potential to cause light spill effects to nearby residents and glare effects to drivers of vehicles.

Most of the proposed Expressway when it is in operation will not be illuminated as it is unnecessary for a rural or semi-rural environment. However, lighting will be required for traffic and pedestrian safety at interchanges and along the proposed cycleway/walkway, as well as on underbridges where there is regular pedestrian activity. The proposed lighting in these locations seeks to achieve a balance between illumination for road safety and reduction of light pollution to the immediate surroundings.

Operational lighting from the cycleway/walkway would create light spill and glare effects in two sections of residential properties, however all identified potential and actual lighting effects of the cycleway/walkway can be effectively avoided, remedied or mitigated through measures including detailed design features and monitoring.

Overall, the potential for the Project to create adverse lighting effects is considered low, given that all potential and actual effects can be effectively avoided, remedied and/or mitigated.

This assessment is conservative given that it has not considered the natural land profiles or the potential for the physical blocking of the emitted light by solid fences, vegetation and trees in specific locations along the proposed Expressway. Thus, the actual level of potential adverse effects from lighting is likely to be considerably less than that identified by this assessment. Consideration of the potential use of landscape planting and noise attenuation measures to screen light will be made during the detailed design phase where effects are potentially more than minor.

The proposed lighting for the Project will therefore achieve satisfactory illumination for road safety as well as effective mitigation of light pollution to the immediate surrounds.

18.1 Introduction

This Chapter assesses the potential lighting effects from the headlights of vehicles using the proposed Expressway, and from the proposed illumination of on and off ramps, interchanges, underbridges, the shared cycleway/walkway, and construction activities (including the lighting of construction yards) forming part of the Project. The assessment considers the potential after-dark effects of lighting on vehicles and residents including spill, glare, sky glow and headlight sweep. The visual appearance of the

proposed lighting poles is considered in the Assessment of Landscape and Visual Effects, Technical Report 7, Volume 3.

There are different lighting standards applicable to the different parts of this Project including the proposed Expressway and roads, the cycleway/walkways, and temporary construction yards (refer to the Assessment of Lighting Effects, Technical Report 8 in Volume 3 for details of applicable standards).

The assessment of lighting effects was undertaken on a generic alignment-wide basis, and did not take into account natural land profiles or physical blocking of the emitted light by solid fences, vegetation and trees (refer to Technical Reports 7, the Assessment of Construction Air Quality Effects, Technical Report 14 and the Assessment of Traffic Noise Effects, Technical Report 15, within Volume 3). All of these factors would have the effect of further reducing spill light and glare on the immediate surroundings, particularly to residential properties. Therefore, the actual level of potential adverse effects from lighting is likely to be considerably less than that identified by this assessment.

This assessment is based on preliminary design concepts only and some of the finer technical details cannot be confirmed until the final design phase of the Project occurs.

The full assessment of potential lighting effects within each of the four sectors of the Project is provided within Technical Report 8, Volume 3. Reference should be made to the lighting, marking and signage drawings CV-MF-101 to 132, Volume 5, which illustrate an indicative design for the location and type of lighting installation which is likely to be used and the assessment of lighting effects drawings CV-MF-700 to 780, Volume 5, which illustrate the potential light spill levels in relation to surrounding properties from such lighting.

The assessment of Landscape and Visual Effects (Technical Report 7 in Volume 3), the Urban Landscape Design Framework (Technical Report 5 in Volume 5) and the CEMP in Volume 4 all address lighting design and mitigation of effects. As such, these reports have been cross referenced throughout this Chapter.

18.2 Lighting environment

18.2.1 Existing lighting environment

Existing lighting within the Project area contains a mix of road lighting, including those designed to Category V3 and Category V4 standard as defined by the Road Lighting Standard AS/NZS 1158. These standards ensure safe vehicle movement and the timely identification of objects and pedestrians, to the motorist's eye, while travelling at speed during the darkness hours.

Category V3 standard lighting is required for:

- Freeways, motorways and expressways consisting of divided highways for through traffic with no access for traffic between interchanges and grade separation at all intersections; and
- Arterial roads that predominantly carry through traffic from one region to another, forming principal avenues of communication for traffic movements.

Category V4 standard lighting is required for:

- Sub-arterial or principal roads which connect arterial or main roads to areas of development within a region, or which carry traffic directly from one part of the region to another part.
- The Road Categories and their associated lighting levels are detailed in Appendix A, Technical Report 8, Volume 3.

18.2.1.1 Sector 1

There is road lighting currently installed on existing SH1 for approximately 150m leading up to the existing SH1/Poplar Avenue junction (when approaching from the south) and on the junction itself.

There is no road lighting along SH1 on the northern side of this junction. This existing lighting has been assessed as greater than a Category V4 standard but not as high as Category V3. There is no existing road lighting on Poplar Avenue.

As no cycleway/walkway path exists in this sector of the Project area currently, there is no existing cycleway/walkway lighting in its proposed location.

18.2.1.2 Sector 2

There is existing Category V4 standard street lighting on Raumati Road and Rata Road within the immediate area where the proposed Expressway underbridge will be located.

Kāpiti Road has existing Category V3 standard street lighting within the immediate area where the full interchange will be located.

As no cycleway/walkway path exists in this sector of the Project area currently, there is no existing cycleway/walkway lighting in its proposed location.

18.2.1.3 Sector 3

There is existing Category V4 standard street lighting on Te Moana Road within the immediate area where the interchange is proposed. There is no lighting currently on the proposed Expressway corridor.

As no cycleway/walkway path exists in this sector of the Project area currently, there is no existing cycleway/walkway lighting in its proposed location.

18.2.1.4 Sector 4

There is no lighting currently on the Designation corridor, although there is minimal road lighting on existing SH1 to illuminate the existing junction with Peka Peka Road. There is no existing lighting on Peka Peka Road or where the Ngarara Road connection into existing SH1 is being proposed.

As no cycleway/walkway path exists in this sector of the Project area currently, there is no existing cycleway/walkway lighting in its proposed location.

18.2.2 Proposed lighting environment (including construction yards)

Large sections of the proposed Expressway will not be illuminated. It is proposed not to light the sections where the proposed Expressway will pass through rural environments. It is common practice not to light sections of roads in rural environments. Lighting is only proposed in locations where it is required for traffic and pedestrian safety. In these locations, the Project proposes lighting that, without mitigation measures, would have the potential to have adverse effects on the surrounding environment. The assessment of effects is limited to the locations where lighting is proposed to be installed, i.e. the following specific locations:

- **The four proposed interchanges and along on/off ramps.** Lighting of these sections is necessary to illuminate curves ahead, the road channels, changes in alignment, road surface markings and kerb locations, as well as any stalled or stationary vehicles;
- **Road bridge structure underlighting will be provided beneath the proposed Expressway where it passes over local roads or the cycleway/walkway path.** The locations where underlighting is proposed are limited to those which are expected to have significant pedestrian use; at Poplar Avenue, Raumati Road, Kāpiti Road, Mazengarb Road and Te Moana Road;
- **On the cycleway/walkway path between Raumati Road and Mazengarb Road.** Lighting is proposed on the path lengths which are expected to be most populated rather than along the full length. This is to provide lighting in areas where there is potential for early evening use of the path in the darker winter months by commuters and school children¹²⁷. The lighting of the path will assist the users to orientate themselves, detect potential hazards and provide a safer environment; and
- **Construction yards.** Some of the proposed construction yards will require mobile lighting towers to be erected on a temporary basis to facilitate night works. In addition, lighting will be provided to guide staff, plant and vehicles at the start and end of each shift during the winter months.

Additional lighting, which is not anticipated to generate adverse effects, is expected to include:

- Flag lighting, usually consisting of single road lanterns, provided at isolated roads where required;
- Low level lighting at the locations where the cycleway/walkway path intersects with local roads;
- There is a proposal to provide further architectural or specialist lighting to the bridges. This lighting is likely to be LED¹²⁸ strip based or narrow beam uplighters, positioned to highlight specific aspects of the bridges;
- Small illuminated signs at each entrance or egress point of the pedestrian/cycle way; and

¹²⁷ The proposed extent of the path lighting resulted from discussions undertaken during the Design Workshop stages with Kāpiti Coast District Council's representatives.

¹²⁸ LED – Light emitting diode lighting

- A number of Vehicle Management Signs (VMS), which will provide adjustable messages to the motorist, including those relating to road conditions and speed limitations.

It is noted that these additional lights are under consideration and/or awaiting detailed design. Reference should be made to the drawings CV-MF-101 to 132, Volume 5, for the likely location of lighting installations.

18.3 Assessment methodology

As it is proposed to be authorised by a designation, the Project is not required to comply with any lighting standards within the Kāpiti Coast District Plan. Recognition has however been given to outcomes sought by KCDC.

It is appropriate that temporary construction yard lighting and the cycleway/walkway lighting conforms to the relevant standards in the Plan, as these provide lighting assessment criteria appropriate to the surrounding receiving environments.

The Plan states that 10 lux¹²⁹, measured 1.5m within a residential boundary, is an appropriate guidance level for acceptable spill light and glare to a residential property, however a lower value of 3 lux at the residential property boundary point has been taken for the assessment.

As there are no applicable District Plan rules for road lighting spill light, a German survey¹³⁰ on spill lighting has been used to provide guidance on an applicable level of assessment. This survey concluded that, with illuminance of more than 3 lux at a window, complaints relating to interior brightness of a room predominated and from above 5 lux at a window, health impairment might become a factor.

In order to assess the effects of the proposed Expressway, cycleway/walkway and construction activity lighting, drawings (CV-MF-700 to 780, Volume 5) have been created to illustrate the anticipated extent of the areas where light levels could exceed 10 lux (based on the Plan standards) and 3 lux (based on findings of the German Survey) at surrounding properties.

¹²⁹ Lux is the unit used to measure illumination.

¹³⁰ E.Hartmann, M. Schinke, K. Wehmeyer, H. Weske – Measurement and Judgment of the Light Emissions of Artificial Light Sources – Short Report. Conducted by the Institute of Medical Optics of the University of Munich., 1984.

18.4 Assessment matters

18.4.1 Potential environmental issues

18.4.1.1 Type of luminaires¹³¹

The types of luminaires proposed for the Project are listed in Appendix C of Technical Report 8, Volume 3. To minimise both glare and light spill, the lighting proposed for the Project consists of a mix of semi-cut off luminaires¹³² and fully cut-off luminaires¹³³, depending on the sensitivity of the surrounding area (for illustrations refer to Appendix E, Technical Report 8, Volume 3).

18.4.1.2 White light/golden white light

The use of white light for the road lighting on this Project is not considered critical to enhance the perceived colourfulness and brightness of the surrounding environment. HPS¹³⁴ lighting design is proposed in the indicative design, providing a golden white light.

18.4.1.3 Road lighting

All the road lighting on the proposed Expressway will be installed to Category V3 standards and all lighting on sections of local roads will be installed to Category V4 standards. Generally, the sections of local roads illuminated will be illuminated either to Category V4 standards or to a level set in discussion with the KCDC. This is not expected to be above the Category V4 illumination standard and may well be below this.

18.4.1.4 Cycleway/walkway lighting

The indicative design is based on a Category P4 level¹³⁵ in accordance with the Road Lighting Standard AS/NZS 1158. Given that the spacing of light poles is yet to be confirmed, a worst case scenario has been provided for this assessment with the lighting assumed to be continuous at nominal 40m centres. The location and type of any special lighting required for cycleway bridges will be further determined at the detailed design stage.

¹³¹ Luminaires refers to a complete lighting unit.

¹³² Semi cut off luminaires have an upward light content restricted to 10 degrees above the horizontal plane.

¹³³ Fully cut off luminaires have upward light content restricted to below the horizontal plane.

¹³⁴ HPS – High pressure sodium.

¹³⁵ Category P4 design standards apply to pedestrian or cycle orientated pathways with low risk of crime and low pedestrian/cycle activity.

18.4.1.5 Light poles

Different location arrangements of lighting poles have been selected in the indicative design to give satisfactory illumination for the proposed Expressway. The height of the poles is a compromise between the desired uniformity of light, spacing, illumination levels and value for money. Standard galvanised lighting poles and offset arms are proposed for road lighting. The poles are of slim line appearance and are not obtrusive to view. The visual effects of the lighting poles have been further addressed and modelled in the Assessment of Landscape and Visual Effects (Technical Report 7, Volume 3).

18.4.1.6 Construction yards and activities

Night time works will be required at times throughout the construction phase (being approximately 4 to 5 years, across a number of work phases as described further in Chapter 8 of the AEE). Works are required at night to minimise disruption to existing local road traffic during the day. Activities which are likely to require night works and associated lighting are detailed within Technical Report 4, Volume 3 and include:

- Erection of bridges at:
 - Raumati Road
 - Kāpiti Road
 - Mazengarb Road
 - Otaihanga Road
 - Te Moana Road
 - Ngarara Road
- Widening of Kāpiti Road (to the east and west of the Kāpiti Road Interchange)
- General Traffic Management throughout the life of the contract (all Sectors)

At these locations (illustrated on drawings CV-CM-400 to 411, Volume 5), the site and adjacent construction yard will require illumination during the night to complete the required operations. During the erection of the bridges at each of the above locations, the precast yard on Otaihanga Road will also be illuminated to enable loading of bridge units.

Mobile lighting towers will be erected on a temporary basis for night works. These towers are typically less than 6m high and mounted on mobile trailers. They can be positioned to effectively minimise any light directed to any adjacent residential property.

Each construction yard area will utilise temporary lighting to enable operations to proceed during the hours of darkness during the winter period. In addition, lighting will be provided to guide staff, plant and vehicles at the start and end of each shift during the winter months.

18.4.2 Potential adverse effects

The potential adverse effects from lighting associated with the construction and operation of the Project on vehicles and residents are limited to:

- Spill lighting

With all exterior lighting, a small percentage of light will not fall within the target area. The result is wasted 'light spill', which can fall into areas where it is not wanted, such as residences adjacent to the lighting.

- Glare

Glare is the brightness of a luminaire when compared with the brightness of the background against which they are seen. For instance, a road luminaire looks much brighter (and has higher glare) when viewed against a black sky than when viewed in the surroundings of a brightly lit city street.

There are two forms of glare. Disabling glare is so intense 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.

- Sky glow (upward light content)

Sky glow is a glow above a road when humidity is high. This effect is difficult to mitigate, as it is light that reflects either directly or indirectly off the road surface and illuminates water particles suspended in the air, giving a glow effect. Sky glow can be reduced by using darker coloured surfaces (i.e. black asphalt), rather than a light coloured chipping and dark painted or coloured concrete, rather than white.

- Headlight sweep

Headlight sweep relates to the aim and intensity of vehicle headlights. This is most likely to affect residents when headlights are directed toward a dwelling.

18.5 Assessment of operational lighting effects

The position of the indicative lighting (illustrated in drawings CV-MF- 101 to 132, Volume 5) and the specific type of luminaires proposed will achieve appropriate safety requirements while mitigating adverse lighting effects.

The lighting environment will be different for some residents due to the increased light levels and coverage brought about by the proposed lighting, especially in areas where currently there is no lighting. However, the new lighting proposed is also required to provide lighting levels appropriate to ensure safety for road and pedestrian users. The 3 lux limitation line on the drawings indicates where a lighting level would be considered an acceptable level (3 lux or less) or an adverse level (higher than 3 lux).

This section provides an assessment of the potential effects resulting from the proposed operational lighting.

18.5.1 Spill lighting and glare

Spill lighting and glare is easily mitigated through good lighting design practice and the use of modern luminaires. Therefore, it is unusual for any adjacent residential properties to be adversely affected. This is illustrated within drawings CV-MF-700 to 780, Volume 5, which show no dwellings affected by a light level above 3 lux, where health effects may arise (according to the German Survey discussed above).

There are two specific areas (both located within Sector 2) where, without any mitigation in place, the cycleway/walkway lighting could intrude into residential properties and be a source of irritation:

- Along the southern approach to the Kāpiti Road interchange (refer to drawings CV-MF-730 and CV-MF-740, Volume 5); and
- Along the northern section, immediately before the Mazengarb Road connection (refer to drawing CV-MF-741, Volume 5).

In these areas, the cycleway/walkway path is immediately adjacent to the back yards of existing residential properties. Without any mitigation, the combined lighting effect of this path and adjacent proposed Expressway lighting will exceed the 3 lux level, but not the 10 lux (within 1.5m of the property) level at both locations.

Mitigation is proposed at these locations and will be achieved through a selection or combination of:

- detailed design features; and/or
- installing the lighting onto the acoustic fence; and/or
- reducing the height of the cycleway light poles within these sections.

With these mitigation measures in place, effects of light spill and glare on these locations will be negligible. The adverse effects from the proposed cycleway lighting will be negligible in all other sections of the alignment, generally due to the distance of the path from adjacent residential properties.

18.5.2 Sky glow

The effect of sky glow is the combined result of thousands of road light fittings combined with the general exterior lighting installed in residential and commercial properties.

The additional lighting proposed in this project would not add to the existing skyglow effect by any significant degree. Given the limited amount of lighting that is proposed for this Project and the

photometric¹³⁶ characteristics of the proposed road lanterns, it is considered extremely unlikely that the reflected (direct or indirect) light will be at a high enough level to increase any existing sky glow effect.

The effects of the Project on sky glow are therefore considered negligible.

18.5.3 Headlight sweep

The potential effects of vehicle headlights are limited to their sweep around bends. Across the majority of the proposed alignment, there are buffer distances between the proposed road carriageway and any adjacent properties. Given the width of the buffer zone, the effect on adjacent residential properties can be considered negligible.

In addition, the retention of dunes where practicable, noise mitigation measures (such as noise walls) and planting for amenity effects in combination with these buffer distances will further obscure and minimise headlight sweep beyond the extent of the proposed alignment. While there may be headlights visible or partially visible in places along the alignment, these are unlikely to be visually intrusive.

18.6 Assessment of construction lighting effects

During construction, temporary lighting will be required in the main construction areas for any work carried out during the hours of darkness. Given good design practice and the use of modern luminaires, spill lighting is not anticipated to cause any nuisance to surrounding residents and glare from temporary lighting can be easily contained such that any potential to degrade the driving ability of motorists is avoided.

18.7 Measures to avoid, remedy or mitigate actual or potential adverse effects of lighting

18.7.1 Mitigation of operational lighting effects

While road lighting will be of a higher illumination level and greater coverage area in certain locations, the choice of luminaires, both for interchanges and road sections has been based on the specified illumination for road safety, spacing and reduction of light pollution to the immediate surrounds.

As outlined above, there are only two specific areas where lighting (from the cycleway/walkway) could intrude into residential properties and be a source of irritation. Physical barriers, luminaire back shields or specific redesign will effectively mitigate light spill at both of these locations down to an acceptable level (3 lux or less). With this mitigation in place, the effects of operational lighting on residential properties are considered extremely low.

¹³⁶ Photometric characteristics refer to the properties of light, especially luminous intensity.

It is further noted that the proposed landscaping (detailed within Technical Report 7, Volume 3) at residential and proposed Expressway boundaries may offer an additional visual barrier that could further reduce the lighting effects identified. There will be some noise mitigation measures (detailed within Technical Reports 15 and 16, Volume 3) which may also act as lighting shields for residents. Coordinating landscape planting with view shafts of lighting that are of concern to any resident might also be used. This can be addressed at detailed design phase of the Project.

18.7.2 Mitigation of construction yard lighting effects

18.7.2.1 Mitigation through detailed design

Construction yard lighting has not yet been designed. Lighting design plans for construction yards will be submitted by an accredited Illumination Engineer as part of the Construction Management Plan in Volume 4.

All design and installation of construction yard lighting will seek to minimise adverse or stray lighting effects. The lighting of construction yards can be designed to be fully compliant with the relevant lighting standards of the Kāpiti Coast District Plan and the relevant clauses of the Australian Standard (AS 4282).

Construction lighting is usually relatively transitional and will be reduced with careful location of yards, site offices and equipment in relation to any adjoining residentially zoned areas. The locations of construction yards for this Project were selected as far from residential properties as practicable, with a 10m minimum buffer zone between any equipment requiring light and a residential boundary.

18.7.2.2 Construction management

The CEMP, Volume 4, proposes to manage the potential impacts of temporary lighting during construction at paragraph 3.5.9.

The following requirements may form part of the CEMP:

- Use luminaires that do not produce environmental spill light above any relevant Kāpiti Coast District Plan standards; and
- Monitor lighting during construction every 2 months or following a complaint from an adjacent resident. Monitoring will include visual tests to check that luminaires have not been re-aimed inappropriately. Monitoring will include visual tests to check that luminaires have not been re-aimed inappropriately.