

NR/L2/CIV/003/Form D: Architectural and layout acceptance				
Document reference	160474-TAZ-OXF-DCL-FOD-EAR-010001	Revision	A04	
Stage	1) Single option and/or for Planning Application 2) Approval in Principle 3) Detailed Design	Date	09.02.24	

LIGHTING IMPACT ASSESSMENT

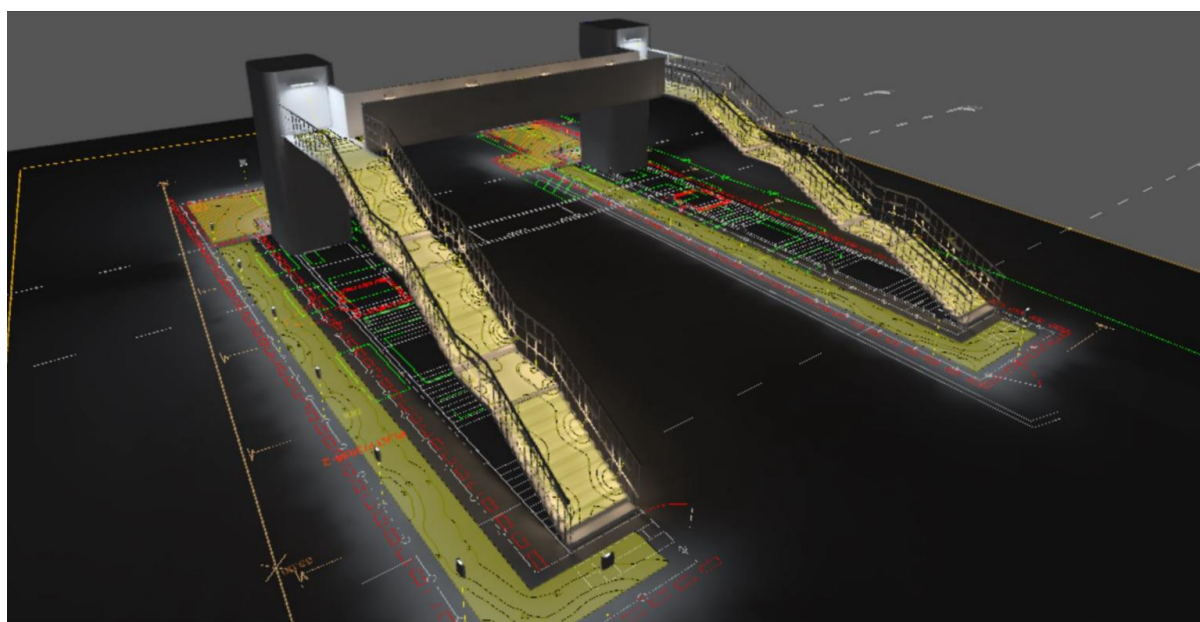


Figure 47: Extract from the DIALux lighting calculations model showing light dispersion. Note: solid parapets along the adjacent side staircase will reduce light radiation into neighbouring properties even further.

The lighting arrangement for Tackley has been specifically designed to reduce light pollution and glare as much as is reasonably practicable whilst adhering to current accessibility legislation and technical standards. The design excludes tall lighting columns, which would extend above surrounding features and risk shining into neighbouring properties' windows, instead opting to use wall or handrail mounted units designed to illuminate the staircases, walkways and main span without radiating further into the surrounding environment. Existing station platform lighting is not to be altered as part of this scheme.

Relatively warm lighting, in the 3000K-4000K range has been used throughout. Warm coloured light occupies the lower energy, red end of the light spectrum and has a less significant effect on the human eye's perception of day and night cycles than colder, more blue higher energy light. With the exception of the lighting units illuminating the lift doors, the structure's lights are to be dimmed to reduce glare and light pollution even further.

NR/L2/CIV/003/Form D: Architectural and layout acceptance				
Document reference	160474-TAZ-OXF-DCL-FOD-EAR-010001	Revision	A04	
Stage	1) Single option and/or for Planning Application 2) Approval in Principle 3) Detailed Design	Date	09.02.24	

TYPE	DESCRIPTION	MOUNTING DETAILS	DIMMING	IMAGES
AE 	FOOTFALL LIGHTING LED HANDRAIL - F48 MODULAR LIGHT - ASYMMETRIC WITH CLEAR LENS, 6W EM SELF-TEST 3HR MAINTAINED	MOUNTED WITH IN HANDRAIL	DIMMED TO 60%	
BE 	FOOTFALL LIGHTING ANTI-CLIMB FOR BRIDGE DECK F300 MODULAR LIGHT - ASYMMETRIC WITH CLEAR LENS, 8W EM SELF-TEST 3HR MAINTAINED	MOUNTED ON PARAPET. HEIGHT 1500mm FROM DECK TOP LEVEL	DIMMED TO 55%	
CE 	ASD LIGHTING INVINCIBLE SEALED 1200mm BLACK PRISMATIC 4000K IP66 LED6000, 48.9W EM SELF-TEST 3HR MAINTAINED	MOUNTED ABOVE LIFT DOOR. HEIGHT 2200mm	NO DIMMING	
C1E 	ASD LIGHTING INVINCIBLE SEALED 1200mm BLACK PRISMATIC 4000K IP66 LED4500, 34W, EM SELF-TEST 3HR MAINTAINED	MOUNTED ABOVE LIFT DOOR. HEIGHT 2200mm	NO DIMMING	
D 	DEXTRA LIGHTING OPUS WALLPACK, GREY 4000K, IP66/IK10, OPUWP L15AS, 10.8W	MOUNTED ON FENCE. HEIGHT 1800mm TOP OF LUMINAIRE	DIMMED TO 45%	
DE 	DEXTRA LIGHTING OPUS WALLPACK, GREY 4000K, IP66/IK10, OPUWP L15AS, 10.8W EM SELF-TEST 3HR MAINTAINED	MOUNTED ON FENCE. HEIGHT 1800mm TOP OF LUMINAIRE	DIMMED TO 45%	

Figure 48: Extract from the Mechanical and Electrical Form A Lighting and Small Power general arrangement drawing, ref. 160474-TAZ-OXF-DCL-DRG-EDS-010101, showing schedule of lighting equipment to be used.

1.3.1 Walkway lighting (ref. D/DE)



Figure 49: Dextra 'Opus Wallpack' lighting unit (Dextra Group, 2024).

Walkway lighting is to be provided using the lighting units shown in Figure 49. These are to be mounted at a height of 1.8m onto the rear-side retaining walls and anti-trespass palisade fencing, angled downwards to illuminate the walkway surfacing. The combination of downward angle and position within the reduced level excavation below neighbouring fence level means that the effect of these lighting units on neighbouring properties or the overall night sky is likely to be negligible. These units are to be dimmed, further reducing light pollution levels.

NR/L2/CIV/003/Form D: Architectural and layout acceptance				
Document reference	160474-TAZ-OXF-DCL-FOD-EAR-010001	Revision	A04	
Stage	1) Single option and/or for Planning Application 2) Approval in Principle 3) Detailed Design	Date	09.02.24	

1.3.2 Staircase lighting (ref. AE)

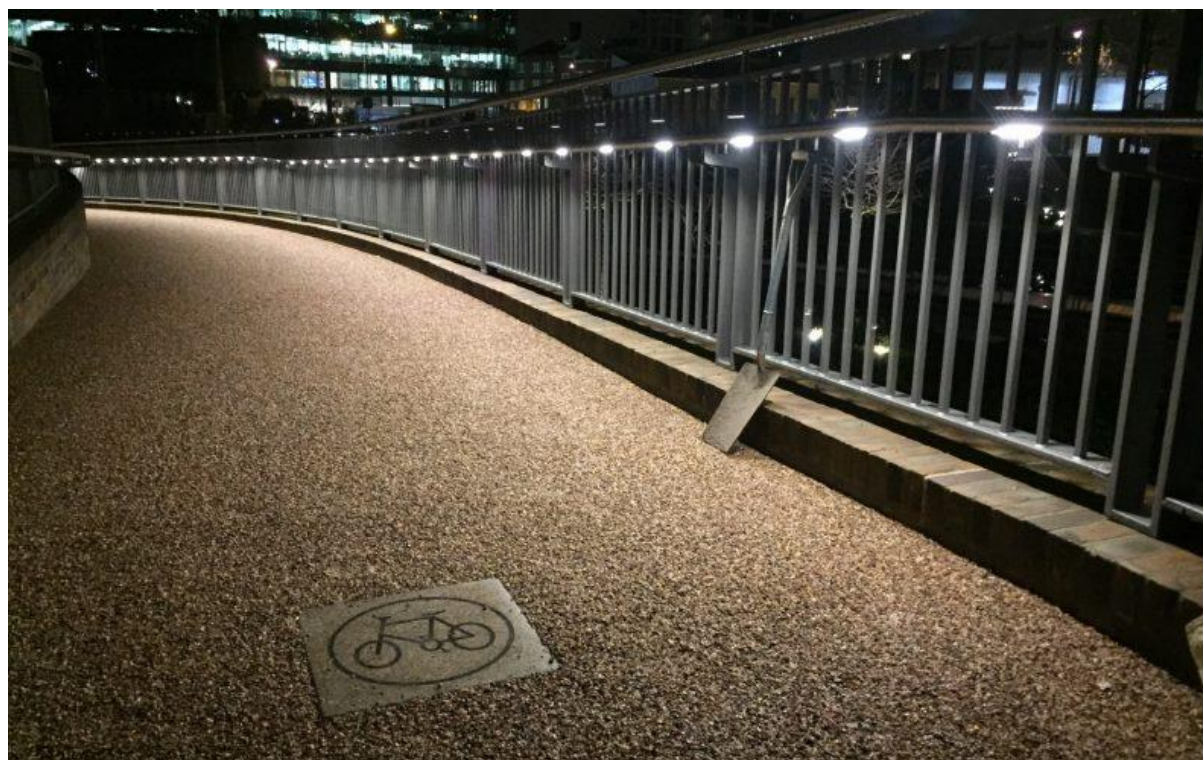


Figure 50: Example installation of Footfall Lighting F48 lighting modules mounted within a handrail (Footfall lighting, 2024).

Staircase lighting is to be provided using Footfall Lighting's F48 modular system, with LED units mounted into the upper handrails at a height of 1m. As with the walkway lighting, these units will be angled downwards to illuminate the stair treads without radiating light horizontally, either towards neighbouring properties or into the open countryside to the east of the bridge. Additionally, the provision of a solid parapet alongside the neighbouring properties will reduce the likelihood of light reaching their windows even further, as the solid parapet will extend 800mm above the downwards angled lighting units.

NR/L2/CIV/003/Form D: Architectural and layout acceptance				
Document reference	160474-TAZ-OXF-DCL-FOD-EAR-010001	Revision	A04	
Stage	1) Single option and/or for Planning Application 2) Approval in Principle 3) Detailed Design	Date	09.02.24	

1.3.3 Main Span lighting (ref. BE)



Figure 51: Footfall Lighting F300 anti-climb lighting units, as proposed (Footfall Lighting, 2024).

Main span lighting is to be provided using Footfall Lighting F300 anti-climb strip lighting units, mounted to the bridge parapet at a height of 1.5m above deck level and angled downwards towards the bridge deck. As with the staircase lighting, these units are to be angled downwards to illuminate the bridge deck surface whilst reducing glare and radiation outwards towards neighbouring properties. The combination of relatively low height, location within the largely enclosed main span structure and downwards angle means that the likely effect of these units is minimal.

NR/L2/CIV/003/Form D: Architectural and layout acceptance				
Document reference	160474-TAZ-OXF-DCL-FOD-EAR-010001	Revision	A04	
Stage	1) Single option and/or for Planning Application 2) Approval in Principle 3) Detailed Design	Date	09.02.24	

1.3.4 Lift door lighting (ref. CE/C1E)



Figure 52: ASD Lighting 'Invincible 1200' angled lighting bar, as proposed (ASD Lighting PLC, 2024).

Exterior lighting for the lift doors is to be provided using ASD Lighting 'Invincible 1200' angled lighting bars, mounted above the exterior doors at a height of 2.2m at a 45-degree angle towards the bridge landings (upper level) or walkway surface (lower level). The lower-level door lights are unlikely to have significant effect on neighbouring properties or the wider night sky environment, however the upper-level door units are likely to pose the most significant impact.

Permanent illumination of lift lobbies to at least 200 lux is a requirement of Network Rail's Standard Specification for New and Upgraded Lifts, ref. NR/L2/CIV/193, and as such the proposed units are as dim as possible whilst complying with applicable technical standards. Lobby lighting is required in order to improve visibility of the lift doors as well as making them more visually distinct from surrounding structures. As these areas typically see more congregation than other parts of the bridge, a sufficient level of lighting is also required for security. It should be noted that the final design is to incorporate canopies above the lift doors, the effect of these has yet to be considered as part of the lighting impact but should act to reduce the light spread and glare resulting from these units.

NR/L2/CIV/003/Form D: Architectural and layout acceptance				
Document reference	160474-TAZ-OXF-DCL-FOD-EAR-010001	Revision	A04	
Stage	1) Single option and/or for Planning Application 2) Approval in Principle 3) Detailed Design	Date	09.02.24	

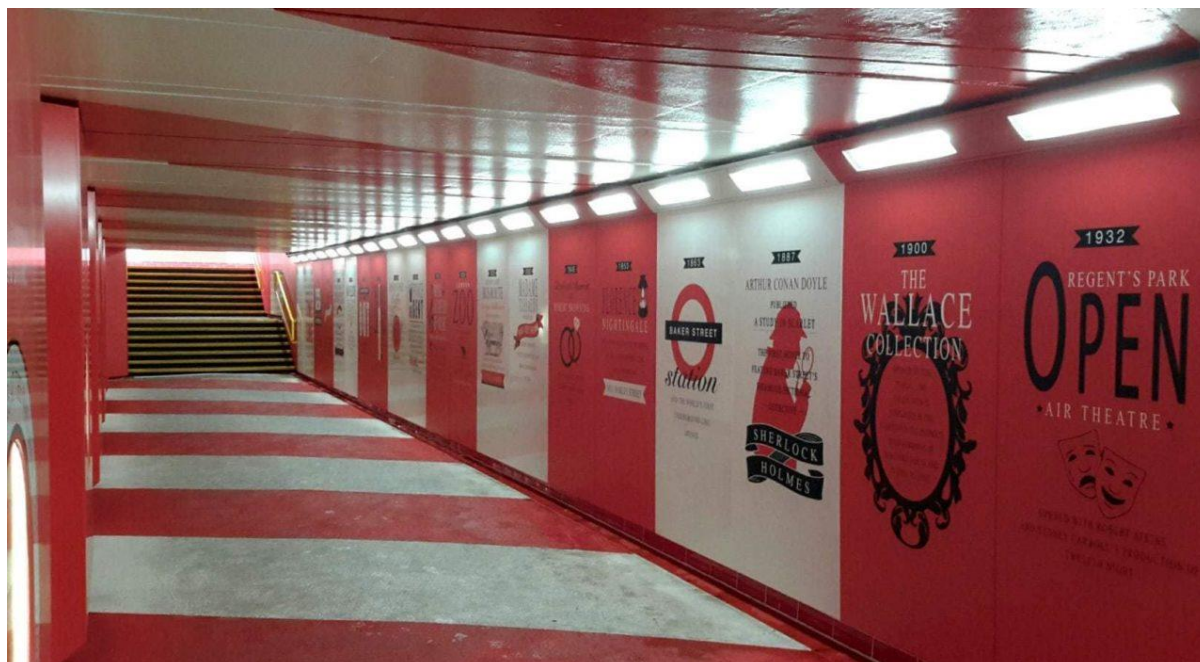


Figure 53: Similar lighting units in use for a pedestrian subway, dubbed the 'Wonderpass'. Only a single unit will be used above each door at Tackley, and as such the lift lobby and landing areas will not appear as bright as here. (ASD Lighting, 2016).

1.3.5 Overall Lighting Impact

To estimate the impact of the proposed lighting system, DIALux lighting modelling software was used to produce a three-dimensional lighting model from which the luminescence levels, light dispersion and glare emitted by the structure's lighting system could be accurately determined. A screenshot of this analysis model is shown in Figure 43.

Within this software, a three-dimensional scale model of the footbridge was created, with lights of the correct type, luminescence level and colour temperature incorporated in their proposed positions. From this, the software can model light levels anywhere on or around the structure, as well as apply shadows where features block the artificial lighting. It can also be used to calculate the glare encountered at points on or near the structure, and for this purpose neighbouring properties were added to the model, the positions of their windows in relation to the structure accurately determined using Ordnance Survey mapping and reference imagery. The software can then calculate the glare levels at each window, accounting for distance from the emitter, shadows cast by features and lux levels emitted by the lighting system.

NR/L2/CIV/003/Form D: Architectural and layout acceptance				
Document reference	160474-TAZ-OUF-DCL-FOD-EAR-010001	Revision	A04	
Stage	1) Single option and/or for Planning Application 2) Approval in Principle 3) Detailed Design	Date	09.02.24	

Properties	$\bar{E}$	E_{min}	E_{max}	$U_o (g_1)$	g_2	Index
Nearby Property Window-1 Vertical illuminance Rotation: 186.7°, Height: 0.650 m	0.31 lx	0.23 lx	0.39 lx	0.74	0.59	CG32
Nearby Property Window-2 Vertical illuminance Rotation: 190.0°, Height: 0.650 m	0.47 lx	0.34 lx	0.60 lx	0.72	0.57	CG33
Nearby Property Window-4 Vertical illuminance Rotation: 192.4°, Height: 0.650 m	0.50 lx	0.45 lx	0.56 lx	0.90	0.80	CG34
Nearby Property Window-3 Vertical illuminance Rotation: 186.5°, Height: 0.650 m	0.41 lx	0.37 lx	0.45 lx	0.90	0.82	CG35

Figure 54: Extract from the DIALux calculation report, showing vertical illuminance levels for four adjacent windows belonging to 59 and 61 Nethercote Road.

Figure 54 shows average luminance levels ($\bar{E}$) from footbridge lighting at the neighbouring window positions, the maximum encountered being 0.5 lux. This is roughly equivalent to the light cast by a full moon on a clear sky and is seven times less bright than the darkest limit of the Civil Twilight, and as such can be considered a minimal effect.

Another concern is glare, or the discomfort or impairment caused by excessive brightness or contrast. As with luminance levels, the modelling software uses light positions, brightness, obstructions, distance, and heights relative to the point of reference in order to estimate the amount of glare experienced by a viewer in specific positions (Glare Rating, GR). These calculations were performed according to the simplified method outlined in EN 12464.

Table 4: Glare values calculated for four window locations belonging to 59 & 61 Nethercote Road.

Point no.	1	2	3	4
Property no.	61	61	59	59
	Nethercote Rd	Nethercote Rd	Nethercote Rd	Nethercote Rd
Strongest glare angle (°)	-33	-33	-33	-33
Max glare	<10	<10	<10	<10
Target glare	≤50	≤50	≤50	≤50
Viewing sector (°)	75-120	45-135	45-135	45-135
Step width (°)	15	15	15	15
Angle of inclination (°)	-2	-2	-2	-2
Height (m)	0.757	0.757	0.757	0.757

NR/L2/CIV/003/Form D: Architectural and layout acceptance				
Document reference	160474-TAZ-OXF-DCL-FOD-EAR-010001	Revision	A04	
Stage	1) Single option and/or for Planning Application 2) Approval in Principle 3) Detailed Design	Date	09.02.24	

GR is measured against a scale ranging from a minimum of 10 and a maximum of 90, and is defined as below:

Table 5: CIE (International Commission on Illumination) Glare Rating (GR) classification.

GR	Classification
10	Not noticeable
20	
30	Noticeable
40	
50	Just admissible
60	
70	Disturbing
80	
90	Unbearable

Table 4 (previous page) shows that glare levels across all four reference points scored less than 10 on the GR scale, and as such the glare effect of the bridge lighting can be considered not noticeable.

In conclusion, the lighting system for the Tackley footbridge scheme has been shown to have minimised the impact of the lighting on its surrounding environment by design as much as is practicable, whilst maintaining compliance with applicable design standards.

NR/L2/CIV/003/Form D: Architectural and layout acceptance				
Document reference	160474-TAZ-OXF-DCL-FOD-EAR-010001	Revision	A04	
Stage	1) Single option and/or for Planning Application 2) Approval in Principle 3) Detailed Design	Date	09.02.24	

The combination of relatively dim lights mounted in a downwards orientation behind parapets and handrails significantly reduces the radiation spread that the footbridge will produce, leading to a barely perceptible increase in luminance levels surrounding the bridge. The surrounding topography and vegetation is also advantageous in this respect – the majority of lit areas will be below the level of the surrounding ground and trees.



Figure 55: Comparison of existing versus proposed lighting impact, as viewed from 61 Nethercote Road.

NR/L2/CIV/003/Form D: Architectural and layout acceptance				
Document reference	160474-TAZ-OXF-DCL-FOD-EAR-010001	Revision	A04	
Stage	1) Single option and/or for Planning Application 2) Approval in Principle 3) Detailed Design	Date	09.02.24	



Figure 56: Comparison of light radiation, existing versus proposed, plan view.

Glare has also been minimised as much as is practicable, this again achieved by using dimmed lights mounted in a downwards orientation. This is important both from the perspective of minimising nuisance to neighbours as well as reducing glare affecting driver's vision.

NR/L2/CIV/003/Form D: Architectural and layout acceptance				
Document reference	160474-TAZ-OXF-DCL-FOD-EAR-010001	Revision	A04	
Stage	1) Single option and/or for Planning Application 2) Approval in Principle 3) Detailed Design	Date	09.02.24	

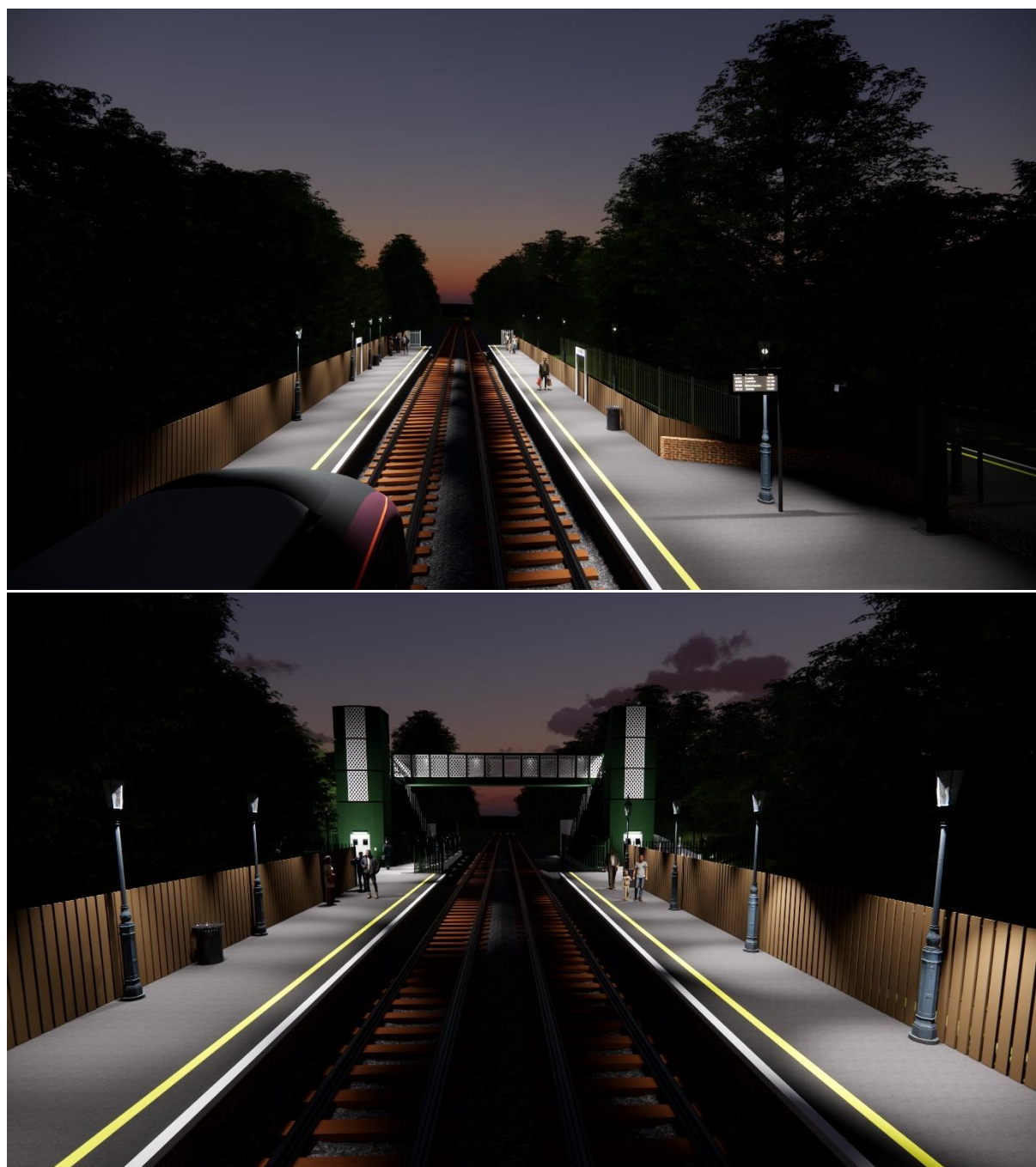


Figure 57: Comparison of lighting impact looking north along the track, existing versus proposed.