



National Highways

M56 LIGHTING RENEWAL

TA 501 Findings Report





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WSP

8 First Street

Manchester

M15 4RP

Phone: +44 161 200 5000

WSP.com

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INTRODUCTION



1 INTRODUCTION

1.1 BACKGROUND

- 1.1.1. A Highway Authority has a power, not a duty, under the Highways Act 1980 (or in Scotland the Roads (Scotland) Act 1984) to provide and maintain road lighting. Similarly, the local Lighting Authority, usually the Parish, Town, District or Borough Council have the power to provide and maintain footway lighting.
- 1.1.2. In exercising its powers regarding the extent, operation and maintenance of its road lighting, a Highway Authority should act reasonably. If it acts in a way that no reasonable Authority would act, then the decision of that Authority could be subject to review in the Courts.
- 1.1.3. National Highways requires the application of The Design Manual for Roads and Bridges (DMRB) and in particular for road lighting the use of TA 501 'Road Lighting Appraisal'.
- 1.1.4. TA 501 relates to the requirements for the appraisal of new and replacement road lighting on motorways and all-purpose trunk roads, which specifically addresses the high-level approach for lighting requirements and determines whether lighting should be provided. TA 501 also refers to the implementation of GG 101 'Introduction to the Design Manual for Roads and Bridges'.
- 1.1.5. TA 501 (Background) states that *"the primary purpose of road lighting for motorways and all-purpose trunk roads is to reduce personal injury collisions (PIC). This is a quantifiable benefit. Consequently, the most important consideration is the predicted accident cost saving, which should be greater than the lighting scheme cost in order to provide economic justification for road lighting"*.
- 1.1.6. The Road Safety Engineer plays a significant role in the road lighting appraisal and shall undertake an evaluation and full accident analysis of the scheme to produce a report to provide justification for not replacing the lighting on the scheme.
- 1.1.7. The scope of TA 501 refers to the assessment of life- expired road lighting and in the context of the M56 From Junction 1 to 6, the lighting and associated infrastructure shall be new or replaced due to its age, as the existing lighting is circa 34 years old and therefore passing its life expiry (30 years). The principles of TA 501 have been followed for the appraisal of the replacement road lighting.
- 1.1.8. The primary purpose of this report is to consider the safety aspects and the economic justification of new or replacing the existing lighting.

1.2 PROJECT BRIEF

- 1.2.1. The purpose of this report is to identify whether a proposed lighting scheme would be beneficial following an economic assessment in accordance with National Highways DMRB Technical Advice Note TA 501 and recommendations presented by the Road Safety Engineer (RSE).
- 1.2.2. The assessment considers the road lighting applicable to the M56 from Junction 1 to J6 mainline only which is inclusive of both entry and exit slips beyond the 5 second rule distance as per Institution of Lighting Professionals (ILP) Professional Lighting Guide PLG 02 – 'The Application of Conflict Areas on the Highway' at each junction. Any junctions and conflict area were excluded from the TA 501 assessment and were considered as to be left illuminated.

1.3 SCHEME DESCRIPTION

- 1.3.1. The length of road considered for the renewal of street lighting is that of the M56 motorway, from Junction 1 with the A34 Kingsway Interchange to J6 till Sunbank Lane overbridge.
- 1.3.2. Within the study area, the M56 forms part of National Highways motorway network in the North West of England and takes the form of a dual carriageway arrangement. The lanes arrangement varies between junctions as:
 - There are two mainline carriageway running lanes from Junction 1 to J3.
 - A section between Junctions 3 and J4 has four mainline carriageways running in each direction, which includes the elevated section of Junction 3A till the merging with A5103, which is a part of scheme's extent.
 - The remaining link from Junctions 5 to 6 have three mainline running lanes in each direction.
- 1.3.3. It is understood that the mainline carriageway of M56 is subjected to the National Speed Limit of 70mph (as posted) for both the eastbound and westbound carriageways, except for at Junction 1 where a permanent 50mph speed limit is enforced over an approximate 560m stretch. These speed limits are indicated by standard road signs

1.3.4. The scheme extents are highlighted in **Figure 1.1** below:

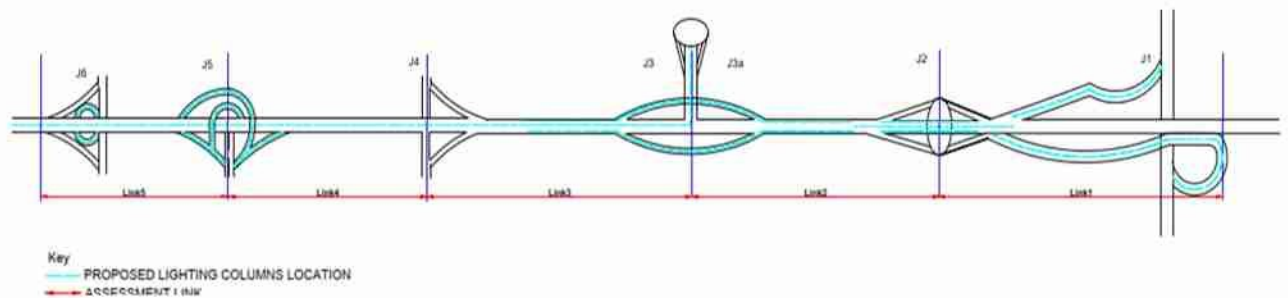


Figure 1-1 – M56 Junctions 1 to 6 Scheme Location

1.3.5. The scheme area has been divided into several assessment links, from Junction centre to Junction centre. The assessment links are as follows:

- Link 1 - J1 to J2
- Link 2 - J2 to J3
- Link 3 - J3 to J4
- Link 4 - J4 to J5
- Link 5 - J5 to J6

Figure 1-2 - Assessment Links



- 1.3.6. Table 1-1 details the criteria considered for determining the link extents and provides commentary on factors for any potential collisions:

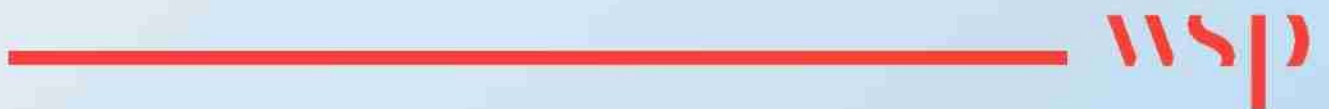
Table 1-1 – Assessment Zone Justification

Assessment Zone	Junction / Access / Link	Higher potential for weaving / queuing	Assessment Zone Considered to ILP PLG 02 distances
Link 1 – J1 to J2	Junction and Link	Yes	Yes
Link 2 – J2 to J3	Junction and Link	Yes	Yes
Link 3 – J3 to J4	Junction and Link	Yes	Yes
Link 4 – J4 to J5	Junction and Link	Yes	Yes
Link 5 – J5 to J6	Junction and Link	Yes	Yes

In the absence of guidance within TA 501 the assessment links were determined following instruction from the client to consider junction centre to junction centre and using design logic of ILP PLG 02. With assessment links considered at diverge / merge locations for a minimum of 156m (5 seconds of driving distance at speed limit of 70mph for the road) at all locations where there is potential to join or leave the main carriageway. This was considered from the last potential exit point or the earliest merge point for example the tigers tail nosing. The locations considered were junctions which enabled a closer look at the potential for Personal Injury Collision (PIC) clusters where vehicle weaving / queuing may occur. It should be noted that there were no major darkness PIC clusters found at any of the assessment zones where access is required.

2

EXISTING LIGHTING



2 EXISTING LIGHTING

2.1 EXISTING LIGHTING ARRANGEMENT

The M56 mainline and slip roads within the scheme area are currently illuminated. Table 2-1 below details the existing extents within the scheme area:

Table 2-1 – Existing Lighting Extents

Links	Extent	Existing Mainline Lighting Arrangement	Comments
1	J1 – J2	Twin Central and Verge mounted	-
2	J2 – J3	Twin Central and Verge mounted	Included spur on A5103
3	J3 – J4	Twin Central and Verge mounted	Lit to SSD from J3 towards J4
4	J4 – J5	Twin Central and Verge mounted	Gyratory of Junctions 5 lit
5	J5 – J6	Twin Central and Verge mounted	Gyratory of Junctions 5 and J6 lit

Across the scheme extents, the mainline is lit including the exit and entry slips, the existing lighting arrangement varies, with a combination of existing double bracket arm columns located in the centre reserve and single arm lighting columns located within the verge being the most common and this arrangement has been utilised between Junctions 1 to J6. A single arm lighting columns in an opposite arrangement located within the verge for Junction 1a to J1.

- 2.1.2. The vast majority of the of the existing lighting have been installed in the 1990's and columns are a mixture of standard hexagonal/ tubular steel columns mounted with HPS (High Pressure Sodium) lanterns that have been manufactured by either Thorn Lighting, Urbis Schreder, Philips Lighting and Siemens.
- 2.1.3. The age of the lighting and the electrical infrastructure is circa 34 years old, and both infrastructures have exceeded their expected life design.
- 2.1.4. For this report only the M56 Junction 1 to J6 mainline and the slip roads beyond the ILP PLG02 5 seconds rule lighting has been assessed.

Table 2-2 – Existing Lighting Arrangement

Links	Quantity	Arrangement
Link 1	135	10m, 12m and 18m nominal height road lighting columns with a double bracket and with single bracket arm and lanterns incorporating a 250w, 135w and 400w HPS SON-T lamps.
Link 2	84	12m and 15m nominal height road lighting columns with a double bracket arm and with a single bracket arm and lanterns incorporating a 400w and 250w HPS SON-T lamps.
Link 3	99	12m and 15 nominal height road lighting columns with a double bracket arm and with a single bracket arm and lanterns incorporating a 400w and 250w HPS SON-T lamps.
Link 4	107	10m, 12m and 15m nominal height road lighting columns with a double bracket arm and with a single bracket arm and lanterns and wall mounted units incorporating a 400w, 250w and 150w HPS SON-T lamps.
Link 5	151	10m, 12m and 15 nominal height road lighting columns with a double bracket arm and with a single bracket arm and lanterns incorporating a 400w, 250w and 150W HPS SON-T lamps.

- 2.1.5. Most of the scheme extents is barrier protected and the re-use of existing barriers to protect any new lighting columns will need to be assessed on an individual basis.
- 2.1.6. No electrical or structural testing information has been used for the purpose of this report and the condition is derived from an existing lighting asset inventory and a visual desktop study.
- 2.1.7. A statistical overview of the assessment links at present and Annual Average Daily Traffic (AADT) sourced from the Department for Transport – Road traffic statistics is provided in Table 2-3 below:

Table 2-3 – Overview of the Scheme Area

Link	Length (km/m)	AADT
1	3.40 km	93,126
2	1.47 km	66,481
3	1.50 km	168,361
4	3.07 km	146,414
5	3.50 km	132,690

3

CONCEPT LIGHTING DESIGN PRINCIPLES AND APPROACH



3 CONCEPT LIGHTING DESIGN PRINCIPLES AND APPROACH

3.1 OVERVIEW

- 3.1.1. To deliver the road lighting appraisal for the lighting, it is necessary to develop a concept lighting design, which will enable the evaluation of both the Capital (CAPEX) and Operational costs (OPEX).

3.2 SELECTION OF LIGHTING CLASSES

- 3.2.1. British Standard (BS) European Standards (EN) 5489-1:2020 'Code of Practice for the Design of Road Lighting – Part 1: Lighting of Roads and Public Amenity Areas' provides guidance on the selection parameters for an appropriate lighting class based on the following criteria and risk assessment approach:
- Road Type
 - Annual Average Daily Traffic (AADT) Flow
 - Road Speed
 - Junction Density
- 3.2.2. Lighting design shall be designed in accordance with DMRB document TD 501.
- 3.2.3. The M56 is defined as a strategic traffic route, "roads where the predominant users are motorised vehicles" BS5489-1 item 7.1 advises that traffic routes are lit to the appropriate M classification is considered.
- 3.2.4. The M56 is deemed to be a strategic traffic route with the national speed limit of 70mph applied throughout the scheme area, except for at Junction 1 where a permanent 50mph speed limit and has several entry, exit slip roads and junctions connecting to it with all links AADT (Annual Average Daily Traffic) considered to be either low to moderate (between 700 and 4000 vehicles) and high to very high (> 40000 vehicles).
- 3.2.5. WSP can determine the appropriate 'M' lighting classification for each of the links using Table A.2 of BS5489-1, as shown in Figure 3.1 below.

Table A.2 — Lighting classes for traffic routes ($v > 40$ mph)

Traffic flow	Lighting class		
	Dual carriageway		Single carriageway
	Junction density: high	Junction density: low	
High to very high ^{A)}	M2	M3	M2
Low to moderate ^{B)}	M3	M4	M3
Very low ^{C)}	M4	M5	M4

NOTE 1 High junction density would be junction centres spaced < 3 km apart.

NOTE 2 Where a single carriageway has a high density of junctions, a risk assessment can determine whether some of the junctions constitute conflict areas (see A.3.2).

NOTE 3 Grey highlighting indicates situations that would not usually occur in the UK.

^{A)} High to very high traffic flow might be defined as either having an average daily traffic (ADT) > 40 000, or where the flow exceeds 65% of the lane maximum capacity for dual or multi-lane carriageways or 45% for single carriageways.

^{B)} Low to moderate traffic flow might be defined as either having an ADT of between 7 000 and 40 000, or where the flow is between 35% and 65% for dual or multi-lane carriageways or between 15% and 45% for single carriageways.

^{C)} Very low traffic flow might be defined as either having an ADT of < 7 000, or where the flow is < 35% for dual or multi-lane carriageways or < 15% for single carriageways.

Figure 3-1 - BS5489-1:2020 - Table A.2

- 3.2.6. Using the information collated on the M56 within the scheme extents we can determine the lighting class for each assessment zone/link based on the road type, traffic flow, road speed and junction density from Table A.2 of BS5489-1 and illustrated in Table 3-1 below:

Table 3-1 – Lighting Level Requirements

Link	Road Type	Traffic Flow	Junction Density	Road Speed Limit (mph)	Determined lighting class
Link 1	Dual Carriageway	High to very high	High	70	M2
Link 2	Dual Carriageway	High to very high	High	70	M2
Link 3	Dual Carriageway	High to very high	High	70	M2
Link 4	Dual Carriageway	High to very high	High	70	M2
Link 5	Dual Carriageway	High to very high	High	70	M2

Table 3-2 - Lighting Level Requirements for Lighting Class M2

Parameter	Value
Lav in cd/m sq (Min Mtd)	1.50 cd/m2 min
Uo (min.)	0.40 min
Ui (min.)	0.70 min
fTI	10% max
Rei	0.35 min

- 3.2.7. An alternative approach could be considered in accordance TD 501 whereby the mainline is unlit to an appropriate tie-in location. The standard advises that there should not be an unlit gap of less than four times the stopping site distance (SSD) as detailed in CD 109 'Highway Link Design' between lit areas. Table 3-3 below details the required SSD for some typical road speeds:

Table 3-3 - Stopping Sight Distances (SSD)

Measurement	Scenario 1	Scenario 2	Scenario 3
Design Speed (mph)	70	60	50
Stopping Distance (m)	295	215	160
Stopping Distance x1.5 (m)	442.5	322.5	240
Stopping Distance x4.0 (m)	1180	860	640

- 3.2.8. The design road speed limit throughout the scheme area is 70mph, therefore if TD 501 and CD 109 were applied there would need to be a minimum of 1,180m of unlit section between the last columns at each junction, however a drop of one step (road speed) is acceptable and therefore reduces extent to 860m, as per CD 109 and TD 501.
- 3.2.9. As there is no requirement to light junctions under TD 501 there is no standard lit approach length to be applied in the assessment, therefore in assessing the approach to the junction a length of 156m has been applied from the exit point nosing this considers the professional guidance from ILP PLG02 to light for 5-seconds of driving distance at the speed limit for the road of 70mph.
- 3.2.10. Note with any future speed reductions the extent can be reduced.

3.3 DETERMINING THE PROPOSED LIGHTING ARRANGEMENT

- 3.3.1. The M within the scheme area can be illuminated through three different lighting arrangement options to achieve the required lighting levels. The options are as follows:
- Opposite arrangement with columns located within the verge.
 - Twin Central arrangement with lighting columns located within the centre reserve.
 - A combination of both verge and twin central lighting.
- 3.3.2. The slip roads and link roads within the scheme area can be illuminated through single-sided arrangement located within the verge.
- 3.3.3. For the purpose of this appraisal, a like-for-like replacement of existing lighting columns in lit sections.
- 3.3.4. The adopted lighting arrangement will need to satisfy the requirements stipulated in both TD 501 and the maintaining agents' specification for the scheme. These are as follows:
- A maximum column height of 15m
 - A maximum bracket outreach of 1.5m
 - Luminaire luminous intensity rating of G4 or above (BS EN 13201-2 – Table A.1)

3.4 LIGHTING ARRANGEMENT

- 3.4.1. A central reserve arrangement is comparable with a verge arrangement in terms of column spacing, however, typically a central reserve arrangement entails a significant reduction in the total number of columns, cabling and associated trenching required. A reduction in columns, cabling and trenching will provide capital cost savings however, this will be offset by the potential requirement to upgrade the vehicle restraint system which would protect the columns from impact.
- 3.4.2. There has been a steer in recent years to remove highways furniture from the central reserve due to the costs and impact associated with the traffic management required to maintain any equipment located within the centre reserve. This needs to be considered in the final design solution.
- 3.4.3. For the purpose of this report, the proposed concept lighting design has been based on the existing arrangement (like for like) and the assessment considers a opposite verge mounted solution for unlit sections. It should be noted that the final design solution may be subject to change or indeed be unlit subject to the outcome of the TA 501 assessment process.

3.5 COLUMN HEIGHTS

- 3.5.1. The existing lighting installation has been used to establish suitable proposed column heights, with either a 12m or 15m solution provided at mainline and 12m or 10m at slip roads. Typically, lighting column heights for similar roads would not exceed 15m unless there were special circumstances which may determine otherwise.

3.6 LUMINAIRE WATTAGE

- 3.6.1. Typically, when using HPS lamps similarly to the existing lighting installation, adopting higher wattage lamps permits a greater spacing between columns and will minimise the capital cost of the scheme. The issue with HPS lamps is that a considerable amount of energy is radiated as heat, however, through the introduction of Light Emitting Diode (LED) luminaires, more energy is converted to light and less is radiated as heat, which makes them a far more energy efficient.

- 3.6.2. Whilst the existing lighting installation consists of several different lanterns and wattages ranging from 135W to 400W for HPS lamps, the proposed concept lighting design utilises LED luminaires with a wattage half of the existing lantern e.g. existing 400W HPS lantern would be replaced with a 200W LED luminaire on a like for like basis with luminaire power outputs ranging between 75W to 200W. This will significantly reduce the overall energy consumption of the lighting installation and subsequently provide a greater reduction on energy.
- 3.6.3. LED luminaires also allow for instant switch on and more efficient switch regimes such as 20 Lux on and 20 Lux off in comparison to HPS lamps which further increases the potential for energy savings. Whilst the integration of a Central Management System (CMS) would enable dimming in hours of low traffic to enhance savings further. It should be noted that HPS units can't implement a CMS.

3.7 PROPOSED CONCEPT LIGHTING DESIGN

- 3.7.1. A design solution for the road lighting was selected against the following criteria:
- The requirement for compliance with the latest design standards specified within DMRB.
 - Selection of the most cost-effective replacement option based on initial capital investment costs and life cycle maintenance.
- 3.7.2. For the purpose of the appraisal, an opposite arrangement located within the verge with either 12m or 15m lighting columns, complete with LED luminaires has been adopted, which achieves the required column spacing of 40m. This satisfies the requirements of BS EN 13201 lighting classes M2 and M3.
- 3.7.3. Table 3-4 provides details on the proposed lighting column and luminaire assets:

Table 3-4 - Proposed Lighting Column and Luminaire Schedule

Links	Columns	Luminaires	Description
Link 1	135	161	10m, 12m and 15m nominal height road lighting columns with a double bracket and with single bracket arm and lanterns incorporating a 125w, 68w and 200w LED Luminaires.
Link 2	84	103	12m and 15m nominal height road lighting columns with a double bracket and with single bracket arm and lanterns incorporating a 125w and 200w LED Luminaires.
Link 3	99	134	12m and 15m nominal height road lighting columns with a double bracket and with single bracket arm and lanterns incorporating a 125w and 200w LED Luminaires.
Link 4	107	129	10m, 12m and 15m nominal height road lighting columns with a twin bracket arm or single bracket arm and wall mounted units incorporating 75W, 125W and 200W LED luminaires.
Link 5	151	200	10m, 12m and 15m nominal height road lighting columns with a double bracket and with single bracket arm and lanterns incorporating a 75w, 125w and 200w LED Luminaires.

4

ECONOMIC ASSESSMENT



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4 ECONOMIC ASSESSMENT

4.1 TA 501 DESCRIPTION

- 4.1.1. This standard sets out the procedure for the appraisal of new and replacement lighting on the strategic motorway and all-purpose trunk road network.
- 4.1.2. This standard should be read in conjunction with the National Highways Scheme Appraisal Report (SAR) or an equivalent appraisal process complying with the Transport Analysis Guidance issued by the Department for Transport (DfT).

4.2 SCHEME APPRAISAL REPORT DESCRIPTION

- 4.2.1. A Microsoft Excel spreadsheet has been used for the SAR, where recent darkness PIC data and proposed scheme costs are inputted to determine whether the proposed scheme costs are beneficial in comparison to the predicted darkness PIC savings over the scheme lifecycle.
- 4.2.2. In order to determine whether a scheme is viable the designer must have the following information:
 - Quantifiable lighting design
 - AADT
 - PIC data for the last 5-year period (3-year minimum)
 - Capital costs (CAPEX)
 - Operating costs (OPEX)
 - PIC's saved in opening year.
- 4.2.3. The above information has been collated from the overseeing organisation utilising TA 501 guidance to extract the necessary values for insertion in the SAR.
- 4.2.4. When the SAR is completed, the scheme is provided with a Benefit Cost Ratio (BCR). If the BCR is greater than 1.0 then the scheme benefits outweigh the scheme costs. Therefore, if the BCR is less than 1.0, then the scheme costs outweigh the scheme benefits.
- 4.2.5. As part of this appraisal, it is advised that a RSR (Road Safety Review) is carried out by a RSE (Road Safety Engineer) to provide an independent view of the proposed lighting scheme from a safety aspect.
- 4.2.6. A risk allowance of 10% has been added to the scheme in accordance with the SAR guidance notes Table C.1 Conception scheme stage without a risk assessment.
- 4.2.7. For the purpose of the SAR, the scheme area was divided into five assessment zones which as detailed in Section 1.3.4

4.3 CAPITAL COSTS (CAPEX)

- 4.3.1. The main cost components for the proposed concept lighting design are as follows:
 - Lighting Columns
 - Feeder Pillars
 - Luminaires

- Cabling/Trenching/Ducting
- Central Management System
- Auxiliary Items

4.3.2. Within the assessment, we have provided indicative quantities of the lighting equipment with an overarching capital cost of £46,000 utilised, which is inclusive of all required works such as feeder pillars, ducting and cabling etc. The overarching capital cost of £46,000 derives from the clients PSC (Professional Services Contract) work brief. Table 4-1 details the design approach and assumptions made to determine quantities:

Table 4-1 - Concept Lighting Design Approach

Item	Approach/Assumption
Lighting Columns	Based on the use of the conventional planted base lighting columns. The use of conventional columns is deemed to be the most economical and can be accommodated within the highway verges and central reserve (where like for like).
Luminaires	For assessment zone 1 to 2 the luminaires used were Signify Luma Gen 2 BGP704 112W & 134W LED luminaires with a luminous intensity rating of G4 and a maintenance factor of 0.83. For links 3 to 4, Signify Luma Gen 2 BGP705 178W & 184W were used with luminous intensity ratings of G4 and G6 and a maintenance factor of 0.83. For links 5 Signify Luma Gen 2 BGP705 156W & 161W were used with luminous intensity ratings of G4 and G6 and a maintenance factor of 0.83.
Feeder Pillars	A budgetary allowance has been made within the overarching capital cost of £46,000 for new replacement feeder pillars and associated DNO (Distribution Network Operator) new connection and transfer of supply costs. It should be noted however that the cost of a new power supply from the DNO can vary significantly in price should a transfer of supply not be achievable.

4.4 OPERATING COSTS (OPEX)

4.4.1. The revenue costs associated with the concept lighting design have been assessed over a 30-year period.

- Energy Consumption
- Maintenance (luminaire cleaning/replacement and column inspections)
- Electrical Testing
- Fault Rectification
- Remedial Works

4.4.2. Table 4-2 details the criteria and assumptions have been applied in relation the operation and maintenance of the lighting assets:

Table 4-2 - Concept Lighting Design Approach

Item	Criteria/Assumption
Electrical Inspection and Testing	Every 6 years
Luminaire Clean and Replacement	Every 6 years
Opening Year Energy Cost	28p/kWhr
Annual Burning Hours (20/20 Lux)	4087
Decommissioning Costs	20% of total capital works costs

4.4.3. Historically for HPS lamps, the cleaning and replacement on trunk roads and motorways typically took place every 3 to 4 years, however, due to the introduction of LED luminaires and more comprehensive research into LED luminaire depreciation has meant that undertaking a clean and replacement of luminaires has increased to 6 years which coincides with the electrical testing and inspection requirements. Through undertaking these activities at the same time under routine maintenance it will result in reduced costs particularly associated with traffic management.

4.4.4. For the purpose of this assessment, a 6-year routine maintenance cycle (inclusive of electrical testing) has been applied and is considered to be an efficient approach in terms of minimising cost.

4.4.5. Refer to Appendix A for the total scheme costs associated with the renewal of the M56 mainline. Table 4-2 summarises the BCR calculation findings based of the mainline assessment.

4.4.6. This report offers options for the lighting within the conclusions and recommendations and based on these options there will be a variation to the costs, these will be subject to the mainline lighting provision and the adjoining slip / merge lighting which is unaccounted for in the SAR.

4.5 PERSONAL INJURY COLLISION COST

- 4.5.1. The cost applied to PIC responses is £188,780 as determined from 'Table A 4.1.4 – Average Value of prevention per road accident by severity and road class of the DfT TAG Data Book May 2024.

4.6 SAR RESULTS

The SAR was undertaken in accordance with TA 501. A summary of the SAR is detailed within Table 4-3:

Table 4-3 - SAR Summary

Assessment Zone	Dark PIC saved in Y1.	Capital Cost (Installation Only, 30yr)	PVC (Present Value Costs)	PVB (Present Value Benefits)	BCR (Benefit Cost Ratio)
Link 1	0.1	£6,452,190.00	£339,554.28	£18,878.00	0.07
Link 2	0.11	£4,014,696.00	£216,325.58	£20,765.80	0.13
Link 3	0.14	£4,731,606.00	£275,279.33	£26,429.20	0.14
Link 4	0.15	£5,113,958.00	£271,663.31	£28,317.00	0.14
Link 5	0.23	£7,216,894.00	£410,606.54	£43,419.40	0.15
All Links (Link 1 to 5) Average/Sum	0.15	£27,529,344.00	£1,513,429.04	£137,809.40	0.12

- 4.6.1. Please refer to Appendix B for individual assessment link SAR results.
- 4.6.2. The SAR Summary detailed within Table 4-3 above shows that none of the assessment links has a BCR value that is greater than 1 and with the overall average BCR of all assessment links calculated at 0.12. This indicates that the scheme costs outweigh the scheme benefits and therefore the lighting is not deemed to be justifiable. An investigation was undertaken to establish the total number of darkness PICs and their severity. A total of 38 darkness PICs occurred within the scheme extents, two of which were attributed to driver gross negligence.
- 4.6.3. Under previous guidance documents it was advised that a 10% PIC saving may be offered by the provision of lighting, however, a 5% PIC saving has been calculated by the Road Safety Engineer for the scheme meaning for this scheme a yearly saving of 0.0716 darkness PICs could be made. On-going studies on the network are pointing towards minimal savings (if any) by the provision of lighting on the network. It is thought that the improved visibility of signals, vehicle break lights and

emergency vehicle lights in darkness conditions are a factor in this. Whilst similar PICs in the future would not necessarily be aided by the provision of lighting, as the non-provision of lighting can make drivers more cautious by driving slower in darkness and poor weather conditions, reducing the potential for PICs. Further contributory factors such as the road surface should be considered behind the higher PIC's throughout the scheme extents and other safety mitigations could be considered if deemed necessary.

- 4.6.4. In consideration of the above, it is not considered that the provision of lighting is truly justified when considering all assessment links are not economically justifiable. The provision of lighting between junctions would not allow a sufficient lit length for an eye to adapt to its new light level when entering / leaving from an unlit area, meaning any benefit of lighting provision is lost. As all assessment links have a BCR value that is less than 1.0, this indicates that the overall scheme costs outweigh the scheme benefits, and the provision of lighting would not be justifiable.

- 4.6.5. The SAR summary has been derived by inputting the relevant scheme data as outlined within 4.2.2. and does not include any PIC's in which [REDACTED] was a major factor of the PIC. TA 501 6.10 states '*the PICs shall be rationalised to exclude anywhere [REDACTED] was a significant contributory factor*'. Reference has been made to the STATS19 data (2017-2022) and it is deemed that four darkness can be attributed to [REDACTED] Table 4-4 below details the scheme darkness PICs that were attributed to [REDACTED]

Table 4-4 - Darkness PICs attributed to [REDACTED]

Darkness PIC Reference	Link	Contributory Factors
A1052642	2	[REDACTED]
A1109346	2	[REDACTED]

- 4.6.6. Further information on the PICs recorded within the scheme area can be found within the RSE Report within Appendix C.

5

ROAD SAFETY ENGINEERS REPORT



5 ROAD SAFETY ENGINEERS REPORT

5.1 GENERAL

- 5.1.1. The Road Safety Review has been undertaken by a RSE (Road Safety Engineer) who complies with the requirements given in GG 119 Road Safety Audit.
- 5.1.2. The analysis of the collision data is an essential part of the TA 501 process and particularly in the justification of not replacing the lighting.
- 5.1.3. Following an assessment by the RSE, using TA 501 and a sensitivity test of a 5% PIC saving, they concluded that the provision of street lighting would only provide an average modest collision saving of 0.0716 PICs per year on M56 between Junction 1 to Junction 6, roughly an increase in 1 darkness PIC every 14 years.
- 5.1.4. The RSE report is detailed within Appendix C.

6

NON-QUANTIFIABLE BENEFITS



6 NON-QUANTIFIABLE BENEFITS

6.1 LANDSCAPE, TOWNSCAPE, HERITAGE, AND BIODIVERSITY

- 6.1.1. The presence of lighting within the scheme area offers a disbenefit as there would be a negative impact on the landscape and biodiversity (flora and fauna) through light pollution and from an aesthetic point of view. Although there are no known heritage sites within the scheme area between Junction 1 and 6, the M56 motorway does connect several villages and towns however the removal of lighting would not have a negative impact of the townscapes of these areas.
- 6.1.2. Towns and villages that are near to the scheme include:
- Sharston
 - Sharston Industrial Area
 - Benchill
 - Newall Green
 - Davenport Green
 - Manchester Airport
- 6.1.3. The removal of existing lighting may be of concern to local residents and road users and consultation may be required if the lighting is not to be replaced.
- 6.1.4. The removal of lighting would require a full switch-off to be implemented which should last for an initial period of one year in which time collision and casualty rates shall be monitored to determine whether the removal of lighting is still safe and justifiable.

6.2 JOURNEY AMBIANCE

- 6.2.1. The lighting offers a neutral benefit to the overall journey ambiance as lighting makes driving in the hours of darkness less stressful and more bearable. However, the visible presence of lighting columns and associated equipment in the daytime may distract the road users from their surrounding areas.

6.3 ACCIDENTS

- 6.3.1. Liaison is required with local stakeholders to consider both their needs and requirements on the potential impact the removal of the lighting from M56 Junction 1 to 6 may have. Table 6-1 overleaf details the list of local stakeholders, who may be considered by the overseeing organisation for consultation.

Table 6-1 – Stakeholder Engagement

Stakeholder	Typical Considerations
Emergency Services (Ambulance)	Incident response times Lighting removals impacts
Emergency Services (Fire and Rescue)	Incident response times Lighting removals impacts
Emergency Services (Police/ Incident Response)	Incident response times Lighting removals impacts
National Highways Traffic Officers	Road closures / alternative routes / mobilisation and reopening for traffic Weather Conditions Safe Refuge Lighting removal impact
National Highways Traffic Officers	Road closures / alternative routes / mobilisation and reopening for traffic Weather Conditions Safe Refuge Lighting removal impact
SES (Safety Engineering Standards) Lighting	Lighting removal impact

- 6.3.2. It should be noted that lighting should not be considered as a benefit for maintenance of other highways equipment or technology, due to the maintenance disbenefit that is introduced to the lighting asset maintainer. Task lighting shall be provided for other maintenance works in darkness hours, or they shall be undertaken in daylight conditions.

6.4 PROMOTE ACTIVE TRANSPORT

- 6.4.1. The provision of lighting would not have an impact on the promotion of active transport either through walking or cycling as the M56 is not accessible for either walking or cycling.

6.5 GOVERNMENT POLICY

- 6.5.1. The government policy is to reduce energy in line with NetZero requirements for National Highways 2030 / 2040 / 2050 Targets. The existing assets are life expired therefore the reputational impact of removing equipment that has not been recently installed is low. It should also be noted that much of the scheme area road network is a standard carriageway with mostly straight lines of visibility, however, Junction 6 may be considered as complex, due to the road geometry alignment with varying lines of visibility and this may be considered for lighting. Furthermore, if this was a new motorway in accordance with TD 501 this would not be lit.
- 6.5.2. Subject to the chosen option for the scheme there will be a saving made due to the more energy efficient LED luminaires and operating regimes being used. However, a greater saving is made by

the removal of lighting, meaning the less proposed lighting installed will have a greater saving towards NetZero. Table 6-1 details the total CO₂e emissions for each of the lighting options which are covered in more detail under the conclusions section of this report.

Table 6-2 - Summary of CO₂e Emissions

Assessment Zone	Mainline CO ₂ e Rate* (tonnes/CO ₂ e)	Slip / Merge CO ₂ e Rate** (tonnes/CO ₂ e)	Total CO ₂ e Rate (tonnes/CO ₂ e)
Option 1 – Provision of lighting in Links 1 to 6 (Full Renewal)	94.323	2.572	96.895
Option 2 – Provision of lighting not required (Switch Off)	0	2.572	2.572

* - Excludes entry and exit slip road lighting columns within the sight stopping distance at each junction however includes entry and exit slip road lighting columns outside the sight stopping distance at each junction only.

** - Inclusive of entry and exit slip road lighting columns within the sight stopping distance at each junction only.

- 6.5.3. These figures have been based on the condensed GHG conversion factors 2024 and trading carbon costs for 2024, sourced from the UK government website.

6.6 SEVERANCE

- 6.6.1. Severance in the context of the M56 is not relevant given due to the lack of local roads that pass through the scheme area. There are several clusters of residential properties located sporadically on the outskirts of the scheme area in which the removal of lighting would not impact.

6.7 SECURITY

- 6.7.1. The presence of lighting offers a neutral benefit towards security on this route. If installed it may discourage theft of highway equipment or make it easier for assets to steal, it's provision also provides lighting assets to be stolen e.g. copper cabling.

7

CONCLUSIONS



7 CONCLUSIONS

7.1 CONCLUSIONS

- 7.1.1. Overall, five out of five assessment zones had a $BCR < 1.0$ meaning the full lighting renewal of the scheme area between M56 Junction 1 to 6 could not be justified from the TA 501 assessment when considering the darkness PIC savings against the cost i.e., $BCR < 1.0$ meaning that the costs associated with the lighting renewal outweighs the benefits lighting would provide. The average BCR value for the scheme was calculated 0.12.
- 7.1.2. It is considered that there would not be any non-quantifiable impacts that may justify lighting provision if considered for removal. However, stakeholder engagement is sought to clarify any unknown impacts. Noting the consideration of alternatives to lighting should be considered to mitigate any concerns around lighting removal as the first action.
- 7.1.3. The RSE Report concluded that the removal of the street lighting within the scheme area is unlikely to have a significant impact on the road safety.
- 7.1.4. Following the completion results of the scheme road lighting appraisal there are two viable options that should be considered, and these are detailed in Table 7-1.

Table 7-1 - Summary of Options and Costs over scheme lifecycle

Assessment Zone	Mainline Cost *	Slip / Merge Cost **	Total Cost
Option 1 – Provision of lighting in links 1 to 6 (Full Renewal)	£ 37,155,868.74	£ 1,722,236.97	£ 38,878,105.71
Option 2 – Provision of lighting in links 1 to 6 not required (Switch Off)	£0	£ 1,722,236.97	£ 1,722,236.97

* - Excludes entry and exit slip road lighting columns within the sight stopping distance at each junction however includes entry and exit slip road lighting columns outside the sight stopping distance at each junction only.

** - Inclusive of entry and exit slip road lighting columns within the sight stopping distance at each junction only.

- 7.1.5. The mainline costs are considered in the TA 501, however the slip / merge costs are not. This is because you don't know the slip / merge requirements until the mainline lighting requirements are determined. If the mainline is to be lit then the slips / merge shall be fully lit too, however if the mainline is unlit the slips / merge only need to be lit to ILP PLG 02 requirements to provide 5-second

lit approach to “conflicts” at the SSD for the road speed. To ensure these costs are considered they have been captured in the table above, this ensures the true cost of the installation is accounted for.

- 7.1.6. Option 1 (Full Renewal) is not economically justifiable in accordance with TA 501, whilst there is no requirement to light this route under current guidance. However, there are potentially other unknown benefits that Stakeholders may wish to put forward to justify lighting provision along the full route. It should be noted that there would need to be significant justification for this approach.
- 7.1.7. Option 2 (Switch Off) considers the removal of all lighting and is economically justifiable in accordance with TA 501, whilst there is no requirement to light this route under current guidance. A switch off report would be required to progress this approach unless agreed otherwise with the overseeing organisation.
- 7.1.8. Whilst there is no requirement to light this route in accordance with TA 501, it should be noted that the two options provided ensure a compliant solution with TD 501 as any unlit gaps are greater than four times the SSD as detailed within Section 3.2.8 of this report.
- 7.1.9. The conclusion reached is that a negative BCR indicates that the replacement of the lighting will not offer value for money when compared to the benefits. Whilst based on applying the National Accident Rate and the economical assessment, the justification for lighting is not valid.
- 7.1.10. There are environmental savings to be considered too and whilst it does not impact the outcome of the assessment it should be noted that if less lighting is provided along this route, it will have a positive environmental benefit, which is a consideration under the non-quantifiable impacts of this assessment.

Appendix A

SCHEME COSTS



M53 LIGHTING RENEWAL - COST BREAKDOWN SUMMARY

Running Cost Assessment

Description	M56 J1 - J2
Length (Km)	3.4
Type	Motorway
Class	M2
Assessment Period (yrs)	30

QCY - Small Scheme approval tool

User Input

User inputs column into column

Description	Detailed Description	Interval of maintenance Cycle	Cycles (30yr assessment period)	No of Cycles	Qty per Cycle	Quantity attend per shift	Number of shifts	Unit	Rate	Work Cycle Cost
Replacement of Luminaire with LED unit	Replacement of luminaire at end of life with replacement LED luminaire. Cost make up 12 x £1000 item price = 1 x £335 shift price	12 Years	@ 12yrs & 24yrs	2	161	12	14	epoch	£1,877.92	£173,545.12
Luminaire Clean	Cleaning internal and external surfaces	at electrical testing	@ 6,12,18 & 24 yrs	5	161	60	3	each	£41.89	£5,901.50
Visual inspection of luminaire	Cleaning, adjustment and visual inspection of mechanical components, electrical components and wiring	at electrical testing	@ 6,12,18 & 24 yrs	5	161	60	3	each	£18.70	£3,010.70
Visual inspection of column	Visual inspection of condition of column, base and fittings, electrical components and wiring	at electrical testing	@ 6,12,18 & 24 yrs	5	135	60	3	each	£16.70	£2,534.50
Visual inspection of feeder pillar	Visual inspection of condition of enclosure and support systems, electrical components and wiring	at electrical testing	@ 6,12,18 & 24 yrs	5	2	5	1	each	£0.00	£0.00
Electrical Testing: column and cables	Complete electrical test and inspection Every 6 years (maximum)	6 Years (max)	@ 6,12,18 & 24 yrs	5	135	60	3	each	£112.00	£15,120.00
Electrical Testing: feeder pillar	Complete electrical test and inspection Every 6 years (maximum) expiry of 60year design life	6 Years (max)	@ 6,12,18 & 24 yrs	5	2	2	1	each	£0.00	£0.00
Structural Testing of column	Approves column inspection/testing, especially after	6 Years (max)	@ 15, 21, 27yrs	3	135	60	3	each	£158.60	£21,060.00
Remedial Works	Allowance for attendance at non-routine repairs, e.g. door off, lantern cover off, solitary lamp outage.	As required	normal 3 @ 15, 21 & 27yrs	3	12.88	1	13	8% Of Cycle Cost	£800.00	£8,440.00

Notes From TA501 National prices: £2.11 The average annual costs for remedial (damage and fault) repairs shall be derived by weighting the total costs for the past 5 years.

£2.12 Average annual maintenance costs shall be derived by averaging planned maintenance activities between present and when the road lighting scheme is 20 years old.

Description	TM rate per shift	TM cost per cycle	Additional costs per cycle	Total Works cost per cycle	Total Works cost over installation life	Total TM cost over installation life	Total Additional costs over	Total cost over Installation	Total cost per annum
Replacement of luminaires with LED unit	£1,000	£14,000	-	£173,545	£347,090	£28,000	-	£375,090	£12,503,008
Luminaire Clean	£1,000	£3,000	-	£9,601	£33,008	£10,000	-	£43,008	£1,600,167
Visual inspection of luminaire inc. above	-	-	-	£3,011	£15,054	0	-	£15,054	£301,783
Visual inspection of column inc. above	£0	-	-	£2,526	£12,623	0	-	£12,623	£420,750
Visual inspection of feeder pillar inc. below	£0	-	-	£0	£0	£0	-	£0	£0,000
Electrical Testing: column and cables	£1,000	£3,000	-	£15,120	£75,600	£15,000	-	£90,600	£3,020,000
Electrical Testing: feeder pillar	£0	£0	-	£0	£0	£0	-	£0	£0,000
Structural Testing of column	£0	£0	-	£21,060	£63,180	£0	-	£63,180	£2,106,000
Remedial Works	£1,000	£12,880	-	£8,440	£25,320	£38,040	-	£73,360	£1,932,000
Sub-Totals					£585,871	£96,040		£682,911	£22,864

Total Works Cost over installation Life	£682,911
Total Traffic Management Cost over installation Life	£96,040
Total Additional Costs over installation Life	0
Total Maintenance Cost over installation Life	£682,911
RPI @ 3.9% (Maintenance)	£25,577.50
RPI @ 3.9% (Remedial Works)	£2,760.44
OYMC (energy component)	£98,876
OYMC (maintenance component)	£22,860.62
PVCF: Total inc Factors	£338,554.28
Scheme Lifetime Total Costs	£8,546,960.17

$$PVC \text{ (maintenance)} = OYMC \times CF \times DF \times GTF$$

£ 22,860.62

Yearly Estimated Maintenance Cost = OYMC

CF (Capitalisation Factor - maintenance)

DF - (Discount Factor - to 2027 prices)

GTF - (General Taxation Figure)

CFE (Capitalisation factor for energy)

8% of Link quantity totals = 6 100 coils + 8 columns for remedial works

Table c.3b of SAR User notes 2020

Table c.3a of SAR User notes 2020

Indirect Taxation Factor: TAG Data Book A1.3.1 May 2024

	Cost per Annum	Total cost over installation life (incl RPI)
Construction	£ 367,000.00	£ 6,432,190.00
Energy	£ 24,303.06	£ 757,526.97
CO ₂ (Carbon)	£ 672.67	£ 20,967.26
Decommissioning (20% of Construction Costs)	£ 41,400.00	£ 1,290,438.00
RPI @ 3.9% (Maintenance)	£ 785.92	£ 25,577.50
RPI @ 3.9% (Remedial Works)	£ 75.35	£ 2,760.44
OYMC (energy component)	£ 98,876	
OYMC (maintenance component)	£ 22,860.62	
PVCF: Total inc Factors	£ 338,554.28	Total Cost
Scheme Lifetime Total Costs		£ 8,546,960.17

M53 LIGHTING RENEWAL - COST BREAKDOWN SUMMARY

Running Cost Assessment

Description	M56 J2 - J3
Length (Km)	1.47
Type	Motorway
Class	M2
Assessment Period (yrs)	30

GOV - Small Scheme appraisal tool

User input

User inputs values into columns

Description	Detailed Description	Interval of maintenance Cycle	Cycles (30yr assessment period)	No of Cycles	Qty per Cycle	Quantity attend per shift	Number of shifts	Unit	Rate	Work Cycle Cost
Replacement of Luminaire with LED Unit	Replacement of luminaires at end of life with replacement LED luminaire. Cost make up: 12 x £1000 item price + 1 x £335 shift price	12 Years	@ 12yrs & 24yrs	2	103	12	9	each	£1,077.92	£111,025.76
Luminaire Clean	Cleaning internal and external surfaces	at electrical testing	@ 6, 12, 18 & 24 yrs	5	103	60	2	each	£41.00	£4,223.00
Visual inspection of luminaire	Cleaning, adjustment and visual inspection of mechanical components, electrical components and wiring	at electrical testing	@ 6, 12, 18 & 24 yrs	5	103	60	2	each	£18.70	£1,935.10
Visual inspection of column	Visual inspection of condition of column, door and fittings, electrical components and wiring	at electrical testing	@ 6, 12, 18 & 24 yrs	5	84	60	2	each	£18.70	£1,670.80
Visual inspection of feeder pillar	Visual inspection of condition of enclosure and support systems, electrical components and wiring	at electrical testing	@ 6, 12, 18 & 24 yrs	5	1	5	1	each	£0.00	£0.00
Electrical Testing: column and cables	Complete electrical test and inspection Every 6 years (maximum)	6 Years (max)	@ 6, 12, 18 & 24 yrs	5	84	60	2	each	£112.00	£9,408.00
Electrical Testing: feeder pillar	Complete electrical test and inspection Every 6 years (maximum) expiry of fatigue design life	6 Years (max)	@ 6, 12, 18 & 24 yrs	5	1	2	1	each	£0.00	£0.00
Structural Testing of column	rigorous column inspection/testing, especially after	6 Years (max)	@ 15, 21, 27yrs	3	84	50	2	each	£166.00	£13,104.00
Remedial Works	Allowance for attendance at non-routine repairs, e.g. door off, luminaire cover off, solitary lamp outage	As required	nominal 3 @ 15, 21 & 27yrs	3	6.24	1	6	8% Of Cycle Costs	£500.00	£4,120.00

PVC (maintenance) = OYMC x CF x DF x GTF	£ 216,325.58
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Yearly Estimated Maintenance Cost = OYMC	£ 14,565.04
CF (Capitalisation Factor maintenance)	22.4
DF - (Discount Factor - to 2027 prices)	0.857
GTF - (General Taxation Figure)	5.159
CPE (Capitalisation factor for energy)	89.29

Table c.3b of SARF User notes 2020

Table c.3a of SARF User notes 2020

Indirect Taxation Factor, TAG Data Book A1 3.1 May 2024

8% of Link quantity totals e.g. 100 coils = 8 columns for remedial works

Notes from TAG20 National annex: E2.11 The average annual costs for remedial damage and fault repairs shall be derived by examining the total costs for the past 3 years.

E2.13 Average annual maintenance costs shall be derived by examining planned maintenance activities between present and seven (7) years out.

Description	TM rate per shift	TM cost per cycle	Additional costs per cycle	Total Works cost per cycle	Total Works cost over installation life	Total TM cost over installation life	Total Additional costs over	Total cost over installation	Total cost per annum
Replacement of luminaire with LED unit	£1,000	£9,000	-	£111,026	£222,052	£16,000	-	£240,052	£8,001.717
Luminaire Clean	£1,000	£2,000	-	£4,223	£21,115	£10,000	-	£31,115	£1,037.167
Visual inspection of luminaire	inc. above	-	-	£1,926	£9,631	0	-	£9,631	£321.017
Visual inspection of column	inc. above	£0	-	£1,571	£7,854	0	-	£7,854	£261.800
Visual inspection of feeder pillar	inc. below	£0	-	£0	£0	£0	-	£0	£0.000
Electrical Testing: column and cables	£1,000	£2,000	-	£9,408	£47,040	£10,000	-	£57,040	£1,901.333
Electrical Testing: feeder pillar	£0	£0	-	£0	£0	£0	-	£0	£0.000
Structural Testing of column	£0	£0	-	£13,104	£39,312	£0	-	£39,312	£1,310.400
Remedial Works	£1,000	£9,340	-	£4,120	£12,360	£24,720	-	£37,080	£1,236.000
Sub-Totals				£58,363	£62,720	£42,583		£14,565	

Total Works Cost over installation Life	£39,363
Total Traffic Management Cost over installation Life	£62,720
Total Additional Costs over installation Life	0
Total Maintenance Cost over installation Life	£42,583
RPI	5.30%
Grand Total Maintenance Cost over installation Life	£43,543
Assessment Period (years)	30
Average Maintenance cost per annum	£14,618.14

	Cost per Annum	Total cost over installation life (incl RPI)
Construction	£ 126,800.00	£ 4,014,686.00
Energy	£ 17,939.92	£ 559,187.37
CCL (Carbon)	£ 496.55	£ 6,809.65
Decommissioning (20% of Construction Costs)	£ 25,760.00	£ 802,939.20
RPI @ 3.0% (Maintenance)	£ 500.50	£ 15,015.12
RPI @ 3.9% (Remedial Works)	£ 48.20	£ 1,446.12
OYMC (energy component)	£ 71,511	
OYMC (maintenance component)	£ 14,569.94	
PVC Total Inc Factors	£ 216,325.58	Total Cost
Scheme Lifetime Total Costs	£ 5,399,093.46	

M53 LIGHTING RENEWAL - COST BREAKDOWN SUMMARY

Running Cost Assessment

Description	M56 J3 - J4
Length (Km)	1.9
Type	Motorway
Class	M2
Assessment Period (yrs)	30

GOV - Small Scheme appraisal tool

User input

User inputs values into columns

Description	Detailed Description	Interval of maintenance Cycle	Cycles (30yr assessment period)	No of Cycles	Qty per Cycle	Quantity attend per shift	Number of shifts	Unit	Rate	Work Cycle Cost
Replacement of Luminaire with LED Unit	Replacement of luminaires at end of life with replacement LED luminaire. Cost make up: 12 x £1000 item price + 1 x £335 shift price	12 Years	@ 12yrs & 24yrs	2	134	12	12	each	£1,077.92	£144,441.28
Luminaire Clean	Cleaning internal and external surfaces	at electrical testing	@ 6, 12, 18 & 24 yrs	5	134	60	3	each	£41.00	£5,484.00
Visual inspection of luminaire	Cleaning, adjustment and visual inspection of mechanical components, electrical components and wiring	at electrical testing	@ 6, 12, 18 & 24 yrs	5	134	60	3	each	£18.70	£2,505.60
Visual inspection of column	Visual inspection of condition of column, door and fittings, electrical components and wiring	at electrical testing	@ 6, 12, 18 & 24 yrs	5	99	60	2	each	£18.70	£1,851.30
Visual inspection of feeder pillar	Visual inspection of condition of enclosure and support systems, electrical components and wiring	at electrical testing	@ 6, 12, 18 & 24 yrs	5	2	5	1	each	£0.00	£0.00
Electrical Testing: column and cables	Complete electrical test and inspection Every 6 years (maximum)	6 Years (max)	@ 6, 12, 18 & 24 yrs	5	99	60	2	each	£112.00	£11,068.00
Electrical Testing: feeder pillar	Complete electrical test and inspection Every 6 years (maximum) expiry of fatigue design life	6 Years (max)	@ 6, 12, 18 & 24 yrs	5	2	2	1	each	£0.00	£0.00
Structural Testing of column	rigorous column inspection/testing, especially after	6 Years (max)	@ 15, 21, 27yrs	3	99	50	2	each	£166.00	£15,444.00
Remedial Works	Allowance for attendance at non-routine repairs, e.g. door off, luminaire cover off, solitary lamp outage	As required	nominal 3 @ 15, 21 & 27yrs	3	10.72	1	11	8% Of Cycle Costs	£500.00	£5,060.00

PVC (maintenance) = OYMC x CF x DF x GTF	£ 275,279.33
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Yearly Estimated Maintenance Cost = OYMC	£ 18,540.63
CF (Capitalisation Factor maintenance)	22.4
DF - (Discount Factor - for 2027 prices)	0.857
GTF - (General Taxation Figure)	5.159
CPE (Capitalisation factor for energy)	89.29

Table c.3b of SARF User notes 2020

Table c.3a of SARF User notes 2020

Indirect Taxation Factor, TAG Data Book A1 3.1 May 2024

Notes from TIAS1 National annex: E2.11 The average annual costs for remedial damage and fault repairs shall be derived by examining the total costs for the past 3 years.

E2.13 Average annual maintenance costs shall be derived by examining planned maintenance activities between present and seven (7) years out.

Description	TM rate per shift	TM cost per cycle	Additional costs per cycle	Total Works cost per cycle	Total Works cost over installation life	Total TM cost over installation life	Total Additional costs over	Total cost over installation	Total cost per annum
Replacement of luminaire with LED unit	£1,000	£12,000	-	£144,441	£288,883	£24,000	-	£312,883	£10,429,419
Luminaire Clean	£1,000	£3,000	-	£5,494	£27,470	£10,000	-	£37,470	£1,415,667
Visual inspection of luminaire	inc. above	-	-	£2,506	£12,529	0	-	£12,529	£417,833
Visual inspection of column	inc. above	£0	-	£1,851	£9,257	0	-	£9,257	£308,500
Visual inspection of feeder pillar	inc. below	£0	-	£0	£0	£0	-	£0	£0,000
Electrical Testing: column and cables	£1,000	£2,000	-	£11,068	£55,340	£10,000	-	£65,340	£2,181,233
Electrical Testing: feeder pillar	£0	£0	-	£0	£0	£0	-	£0	£0,000
Structural Testing of column	£0	£0	-	£15,444	£46,332	£0	-	£46,332	£1,544,400
Remedial Works	£1,000	£10,720	-	£5,360	£16,080	£20,160	-	£46,240	£1,608,000
Sub-Total					£455,990	£81,160		£537,150	£17,595

Total Works Cost over installation life	£455,990
Total Traffic Management Cost over installation life	£81,160
Total Additional Costs over installation life	0
Total Maintenance Cost over installation life	£537,150
RPI @ 3.0% (Maintenance)	£20,940
Grand Total Maintenance Cost over installation life	£558,090
Assessment Period (years)	30
Average Maintenance cost per annum	£18,603.00

	Cost per Annum	Total cost over installation life (incl RPI)
Construction	£ 151,890.00	£ 4,731,606.00
Energy	£ 25,673.25	£ 800,235.13
CCL (Carbon)	£ 710.60	£ 831.40
Decommissioning (20% of Construction Costs)	£ 30,960.00	£ 946,321.20
RPI @ 3.0% (Maintenance)	£ 635.58	£ 19,067.48
RPI @ 3.0% (Remedial Works)	£ 62.71	£ 1,881.35
OYMC (energy component)	£ 102,338	
OYMC (maintenance component)	£ 18,540.59	
PVC Total Inc Factors	£ 275,279.33	Total Cost
Scheme Lifetime Total Costs	£ 6,499,942.58	

M53 LIGHTING RENEWAL - COST BREAKDOWN SUMMARY

Running Cost Assessment

Description	M56 J4 - J5
Length (Km)	3.07Km
Type	Motorway
Class	M2
Assessment Period (yrs)	30

GOV - Small Scheme appraisal tool

User input

User inputs values into columns

Description	Detailed Description	Interval of maintenance Cycle	Cycles (30yr assessment period)	No of Cycles	Qty per Cycle	Quantity attend per shift	Number of shifts	Unit	Rate	Work Cycle Cost
Replacement of Luminaire with LED Unit	Replacement of luminaires at end of life with replacement LED luminaire. Cost make up: 12 x £1000 item price + 1 x £335 shift price	12 Years	@ 12yrs & 24yrs	2	129	12	11	each	£1,077.92	£139,051.68
Luminaire Clean	Cleaning internal and external surfaces	at electrical testing	@ 9, 12, 19 & 24 yrs	5	129	60	3	each	£41.00	£5,289.00
Visual inspection of luminaire	Cleaning, adjustment and visual inspection of mechanical components, electrical components and wiring	at electrical testing	@ 9, 12, 19 & 24 yrs	5	129	60	3	each	£18.70	£2,412.30
Visual inspection of column	Visual inspection of condition of column, door and fittings, electrical components and wiring	at electrical testing	@ 9, 12, 19 & 24 yrs	5	107	60	2	each	£18.70	£2,000.90
Visual inspection of feeder pillar	Visual inspection of condition of enclosure and support systems, electrical components and wiring	at electrical testing	@ 9, 12, 19 & 24 yrs	5	1	5	1	each	£0.00	£0.00
Electrical Testing: column and cables	Complete electrical test and inspection Every 6 years (maximum)	6 Years (max)	@ 9, 12, 19 & 24 yrs	5	107	60	2	each	£112.00	£11,984.00
Electrical Testing: feeder pillar	Complete electrical test and inspection Every 6 years (maximum) expiry of fatigue design life	6 Years (max)	@ 9, 12, 19 & 24 yrs	5	1	2	1	each	£0.00	£0.00
Structural Testing of column	rigorous column inspection/testing, especially after	6 Years (max)	@ 15, 21, 27yrs	3	107	50	3	each	£166.00	£16,602.00
Remedial Works	Allowance for attendance at non-routine repairs, e.g. door off, luminaire cover off, solitary lamp outage	As required	nominal 3 @ 15, 21 & 27yrs	3	10.32	1	10	8% Of Cycle Costs	£500.00	£5,160.00

$PVC \text{ (maintenance)} = OVMC \times CF \times DF \times GTF$	£ 271,663.31
---	--------------

Yearly Estimated Maintenance Cost = OVMC	£ 18,207.04
CF (Capitalisation Factor maintenance)	22.4
DF - (Discount Factor - 10 2027 prices)	0.857
GTF - (General Taxation Figure)	5.15
CPE (Capitalisation factor for energy)	89.29

Table c.3b of SARF User notes 2020

Table c.3a of SARF User notes 2020

Indirect Taxation Factor, TAG Data Book A1 3.1 May 2024

8% of Link quantity totals e.g. 100 coils = 8 columns for remedial works

Notes from TAG20 National annex: E2.11 The average annual costs for remedial damage and fault repairs shall be derived by examining the total costs for the past 3 years.

E2.13 Average annual maintenance costs shall be derived by examining planned maintenance activities between present and plan for most lighting schemes in 20 years old.

Description	TM rate per shift	TM cost per cycle	Additional costs per cycle	Total Works cost per cycle	Total Works cost over installation life	Total TM cost over installation life	Total Additional costs over	Total cost over installation	Total cost per annum
Replacement of luminaire with LED unit	£1,000	£11,000	-	£129,002	£278,103	£22,000	-	£300,103	£10,003,445
Luminaire Clean	£1,000	£3,000	-	£5,289	£26,445	£19,000	-	£41,445	£1,381,500
Visual inspection of luminaire	inc. above	-	-	£2,412	£12,062	0	-	£12,062	£402,060
Visual inspection of column	inc. above	£0	-	£2,001	£10,006	0	-	£10,006	£333,483
Visual inspection of feeder pillar	inc. below	£0	-	£0	£0	£0	-	£0	£0,000
Electrical Testing: column and cables	£1,000	£2,000	-	£11,984	£59,920	£19,000	-	£89,920	£2,330,467
Electrical Testing: feeder pillar	£0	£0	-	£0	£0	£0	-	£0	£0,000
Structural Testing of column	£0	£0	-	£16,602	£50,076	£0	-	£50,076	£1,689,200
Remedial Works	£1,000	£10,320	-	£5,160	£15,840	£30,000	-	£46,440	£1,548,000
Sub-Total					£452,900	£77,960		£530,860	£17,868

Total Works Cost over installation life	£402,090
Total Traffic Management Cost over installation life	£77,960
Total Additional Costs over installation life	0
Total Maintenance Cost over installation life	£530,050
RPI	5.10%
Grand Total Maintenance Cost over installation life	£560,722
Assessment Period (years)	30
Average Maintenance cost per annum	£18,357.41

	Cost per Annum	Total cost over installation life (incl RPI)
Construction	£ 164,086.07	£ 5,113,859.00
Energy	£ 22,019.98	£ 689,334.63
CCL (Carbon)	£ 609.48	£ 113.06
Decommissioning (20% of Construction Costs)	£ 32,813.33	£ 1,022,791.60
RPI @ 3.3% (Maintenance)	£ 628.69	£ 18,860.82
RPI @ 3.9% (Remedial Works)	£ 66.37	£ 1,811.16
OVMC (energy component)	£ 67,772	
OVMC (maintenance component)	£ 18,287.04	
PVC Total Inc Factors	£ 271,663.31	Total Cost
Scheme Lifetime Total Costs		£ 6,644,469.26

M53 LIGHTING RENEWAL - COST BREAKDOWN SUMMARY

Running Cost Assessment

Description	M56 J5 - J6
Length (Km)	3.5Km
Type	Motorway
Class	M2
Assessment Period (yrs)	30

GOV - Small Scheme appraisal tool

User Input

User inputs values into columns

Description	Detailed Description	Interval of maintenance Cycle	Cycles (30yr assessment period)	No of Cycles	Qty per Cycle	Quantity attend per shift	Number of shifts	Unit	Rate	Work Cycle Cost
Replacement of Luminaire with LED Unit	Replacement of luminaires at end of life with replacement LED luminaire. Cost make up: 12 x £1000 item price + 1 x £335 shift price	12 Years	@ 12yrs & 24yrs	2	200	12	17	each	£1,077.92	£215,584.00
Luminaire Clean	Cleaning internal and external surfaces	at electrical testing	@ 6, 12, 18 & 24 yrs	5	200	60	4	each	£41.00	£8,200.00
Visual inspection of luminaire	Cleaning, adjustment and visual inspection of mechanical components, electrical components and wiring	at electrical testing	@ 6, 12, 18 & 24 yrs	5	200	60	4	each	£18.70	£3,740.00
Visual inspection of column	Visual inspection of condition of column, door and fittings, electrical components and wiring	at electrical testing	@ 6, 12, 18 & 24 yrs	5	151	60	3	each	£18.70	£2,823.70
Visual inspection of feeder pillar	Visual inspection of condition of enclosure and support systems, electrical components and wiring	at electrical testing	@ 6, 12, 18 & 24 yrs	5	4	5	1	each	£0.00	£0.00
Electrical Testing: column and cables	Complete electrical test and inspection Every 6 years (maximum)	6 Years (max)	@ 6, 12, 18 & 24 yrs	5	151	60	3	each	£112.00	£16,912.00
Electrical Testing: feeder pillar	Complete electrical test and inspection Every 6 years (maximum) expiry of fatigue design life	6 Years (max)	@ 6, 12, 18 & 24 yrs	5	4	2	2	each	£0.00	£0.00
Structural Testing of column	rigorous column inspection/testing, especially after	6 Years (max)	@ 15, 21 & 27yrs	3	151	50	4	each	£166.00	£23,566.00
Remedial Works	Allowance for attendance at non-routine repairs, e.g. door off, luminaire cover off, solitary lamp outage	As required	nominal 3 @ 15, 21 & 27yrs	3	16	1	16	8% Of Cycle Costs	£500.00	£8,000.00

Notes From TAG201 National annex: E2.11 The average annual costs for remedial damage and fault repairs shall be derived by examining the total costs for the past 3 years.

E2.13 Average annual maintenance costs shall be derived by examining planned maintenance activities between present and when the next lighting scheme is 25 years old.

Description	TM rate per shift	TM cost per cycle	Additional costs per cycle	Total Works cost per cycle	Total Works cost over installation life	Total TM cost over installation life	Total Additional costs over	Total cost over installation	Total cost per annum
Replacement of luminaire with LED unit	£1,000	£17,000	-	£215,584	£431,168	£34,000	-	£465,168	£15,505.600
Luminaire Clean	£1,000	£4,000	-	£8,200	£41,000	£20,000	-	£61,000	£2,033.333
Visual inspection of luminaire	inc. above	-	-	£3,740	£18,700	0	-	£18,700	£623.333
Visual inspection of column	inc. above	£0	-	£2,824	£14,119	0	-	£14,119	£470.617
Visual inspection of feeder pillar	inc. below	£0	-	£0	£0	£0	-	£0	£0.000
Electrical Testing: column and cables	£1,000	£3,000	-	£16,912	£84,560	£15,000	-	£99,560	£3,318.667
Electrical Testing: feeder pillar	£0	£0	-	£0	£0	£0	-	£0	£0.000
Structural Testing of column	£0	£0	-	£23,566	£70,668	£0	-	£70,668	£2,355.600
Remedial Works	£1,000	£16,000	-	£8,000	£24,000	£48,000	-	£72,000	£2,400.000
Sub-Total					£664,215	£117,000		£781,215	£26,707

Total Works Cost over installation life	£664,215
Total Traffic Management Cost over installation life	£117,000
Total Additional Costs over installation life	0
Total Maintenance Cost over installation life	£781,215
RPI	5.30%
Grand Total Maintenance Cost over installation life	£332,450
Assessment Period (years)	30
Average Maintenance cost per annum	£27,748.72

	Cost per Annum	Total cost over installation life (incl RPI)
Construction	£ 231,533.33	£ 7,216,894.00
Energy	£ 37,823.56	£ 1,172,664.77
CCL (Carbon)	£ 1,041.31	£ 1,216.33
Decommissioning (20% of Construction Costs)	£ 46,306.67	£ 1,443,378.80
RPI @ 3.3% (Maintenance)	£ 947.06	£ 28,436.37
RPI @ 3.9% (Remedial Works)	£ 83.69	£ 2,806.00
OYMC (energy component)	£ 149,956	
OYMC (maintenance component)	£ 27,055.12	
PVCC Total Inc Factors	£ 410,606.54	Total Cost
Scheme Lifetime Total Costs		£ 8,665,463.27

$$\frac{PVC}{(maintenance)} = \frac{OYMC}{CF} \times \frac{DF}{GTF}$$

$$\frac{Yearly Estimated Maintenance Cost}{CF} = \frac{OYMC}{CF}$$

$$\frac{CF}{(Capitalisation Factor maintenance)}$$

$$\frac{CF}{(Discount Factor - 10\% 2027 prices)}$$

$$\frac{GTF}{(General Taxation Figure)}$$

$$\frac{CFE}{(Capitalisation factor for energy)}$$

8% of Link quantity totals e.g. 100 coils = 8 columns for remedial works

Table c.3b of SARF User notes 2020

Table c.3a of SARF User notes 2020

Indirect Taxation Factor, TAG Data Book A1 3.1 May 2024

Appendix B

BCR CALCULATIONS



M56 LIGHTING RENEWAL

Link 1 - BCR CALCULATION

Guidance Figures for potential Lighting Scheme Full Switch Off

Section:	Link 1	M56 Main line Junction J1 - J2	Annual Costs	£	254,059.46
Length:	3.4 km		Annual Benefits	£	18,878.00
Type:	Verge Main Carriageway		Benefit Cost Ratio		0.07
Class:	M2				

Costs (per annum)

Construction	£	207,000.00
Energy	£	24,303.08
Maintenance	£	20,151.71
Repairs	£	1,932.00
CCL Costs	£	672.67
Decommission cost(20%)	£	41,400.00
Total	£	254,059.46

Energy Calculation

161	Lanterns
130	W per lantern
11.38	hours burn per night
365.26	days
86796.71	kW·hrs per annum
£ 24,303.08	cost @28p/kW·h
17.971	tonnes of CO2
£ 672.67	CCL Cost

Routine Maintenance Calculation

a) Replacement of luminaire with LED unit;	£	12,503.01
b) Luminaire Clean;	£	1,600.17
c) Visual Inspection of luminaire;	£	501.78
d) Visual Inspection of column;	£	420.75
e) Visual Inspection of feeder pillar	£	-
f) Electrical Testing: column and cables	£	3,020.00
g) Electrical Testing: feeder pillar	£	-
h) Structural Testing of column	£	2,106.00
Maintenance costs =	£	20,151.71

Remedial Works

Total repair costs =	£	1,932.00
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Benefits

No. of PICs in past 5 yrs:	10
minus DGNs:	0
Annual accident rate:	2.00
5% of PICs=	0.1
value of acc. savings	£ 18,878.00

£ 188,780.00

(1 kW·h causes 0.20705kg of CO2 2024 Rates)
(2024 CCL Rate 0.00775)

M56 LIGHTING RENEWAL

Link 2 - BCR CALCULATION

Guidance Figures for potential Lighting Scheme Full Switch Off

Section:	Link 2	M56 Main line Junction J2 - J3	Annual Costs	£	161,305.91
Length:	1.47 km		Annual Benefits	£	20,765.80
Type:	Verge Main Carriageway		Benefit Cost Ratio		0.13
Class:	M2				

Costs (per annum)

Construction	£	128,800.00
Energy	£	17,939.92
Maintenance	£	12,833.43
Repairs	£	1,236.00
CCL Costs	£	496.55
Decommission cost(20%)	£	25,760.00
Total	£	161,305.91

Energy Calculation

103	Lanterns
150	W per lantern
11.38	hours burn per night
365.26	days
64071.15	kW·hrs per annum
£ 17,939.92	cost @28p/kW·h
13.266	tonnes of CO2
£ 496.55	CCL Cost

Routine Maintenance Calculation

a) Replacement of luminaire with LED unit;	£	8,001.72
b) Luminaire Clean;	£	1,037.17
c) Visual Inspection of luminaire;	£	321.02
d) Visual Inspection of column;	£	261.80
e) Visual Inspection of feeder pillar	£	-
f) Electrical Testing: column and cables	£	1,901.33
g) Electrical Testing: feeder pillar	£	-
h) Structural Testing of column	£	1,310.40
Maintenance costs =	£	12,833.43

Remedial Works

Total repair costs =	£	1,236.00
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Benefits

No. of PICs in past 5 yrs:	11
minus DGNs:	2
Annual accident rate:	2.20
5% of PICs=	0.11
value of acc. savings	£ 20,765.80

£ 188,780.00

(1 kW·h causes 0.20705kg of CO2 2024 Rates)
(2024 CCL Rate 0.00775)

M56 LIGHTING RENEWAL

Link 3 - BCR CALCULATION

Guidance Figures for potential Lighting Scheme Full Switch Off

Section:	Link 3	M56 Main line Junction J3 - J4	Annual Costs	£	196,088.85
Length:	1.5 km		Annual Benefits	£	26,429.20
Type:	Verge Main Carriageway		Benefit Cost Ratio		0.13
Class:	M2				

Costs (per annum)		
Construction	£	151,800.00
Energy	£	25,673.25
Maintenance	£	16,297.00
Repairs	£	1,608.00
CCL Costs	£	710.60
Decommission cost(20%)	£	30,360.00
Total	£	196,088.85
Energy Calculation		
134	Lanterns	
165	W per lantern	
11.38	hours burn per night	
365.26	days	
91690.17	kW·hrs per annum	
£ 25,673.25	cost @28p/kW·h	
18.984	tonnes of CO2	
£ 710.60	CCL Cost	
Routine Maintenance Calculation		
a) Replacement of luminaire with LED unit;	£	10,429.42
b) Luminaire Clean;	£	1,415.67
c) Visual Inspection of luminaire;	£	417.63
d) Visual Inspection of column;	£	308.55
e) Visual Inspection of feeder pillar	£	-
f) Electrical Testing: column and cables	£	2,181.33
g) Electrical Testing: feeder pillar	£	-
h) Structural Testing of column	£	1,544.40
Maintenance costs =	£	16,297.00
Remedial Works		
Total repair costs =	£	1,608.00

Benefits	
No.of PICs in past 5 yrs:	14
minus DGNs:	0
Annual accident rate:	2.80
5% of PICs=	0.14
value of acc. savings	£ 26,429.20
	£ 188,780.00

(1 kW·h causes 0.20705kg of CO2 2024 Rates)
(2024 CCL Rate 0.00775

M56 LIGHTING RENEWAL

Link 4 - BCR CALCULATION

Guidance Figures for potential Lighting Scheme Full Switch Off

Section:	Link 4	M56 Main line Junction J4 - J5	Annual Costs	£	204,363.55
Length:	3.07Km		Annual Benefits	£	28,317.00
Type:	Verge Main Carriageway		Benefit Cost Ratio		0.14
Class:	M2				

Costs (per annum)

Construction	£	164,066.67
Energy	£	22,019.08
Maintenance	£	16,120.35
Repairs	£	1,548.00
CCL Costs	£	609.46
Decommission cost(20%)	£	32,813.33
Total	£	204,363.55

Energy Calculation

129	Lanterns
147	W per lantern
11.38	hours burn per night
365.26	days
78639.561	kW·hrs per annum
£ 22,019.08	cost @28p/kW·h
16.282	tonnes of CO2
£ 609.46	CCL Cost

Routine Maintenance Calculation

a) Replacement of luminaire with LED unit;	£	10,003.45
b) Luminaire Clean;	£	1,381.50
c) Visual Inspection of luminaire;	£	402.05
d) Visual Inspection of column;	£	333.48
e) Visual Inspection of feeder pillar	£	-
f) Electrical Testing: column and cables	£	2,330.67
g) Electrical Testing: feeder pillar	£	-
h) Structural Testing of column	£	1,669.20
Maintenance costs =	£	16,120.35

Remedial Works

Total repair costs =	£	1,548.00
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Benefits

No. of PICs in past 5 yrs:	15
minus DGNs:	0
Annual accident rate:	3.00
5% of PICs=	0.15
value of acc. savings	£ 28,317.00

£ 188,780.00

(1 kW·h causes 0.20705kg of CO2 2024 Rates)
(2024 CCL Rate 0.00775)

M56 LIGHTING RENEWAL

Link 5 - BCR CALCULATION

Guidance Figures for potential Lighting Scheme Full Switch Off

Section:	Link 5	M56 Main line Junction J5 - J6	Annual Costs	£	296,903.38
Length:	3.5Km		Annual Benefits	£	43,419.40
Type:	Verge Main Carriageway		Benefit Cost Ratio		0.15
Class:	M2				

Costs (per annum)

Construction	£	231,533.33
Energy	£	37,621.58
Maintenance	£	24,307.15
Repairs	£	2,400.00
CCL Costs	£	1,041.31
Decommission cost(20%)	£	46,306.67
Total	£	296,903.38

Energy Calculation

200 Lanterns
162 W per lantern

11.38 hours burn per night
365.26 days

134362.8	kW·hrs per annum
£ 37,621.58	cost @28p/kW·h
27.820	tonnes of CO2
£ 1,041.31	CCL Cost

Routine Maintenance Calculation

a) Replacement of luminaire with LED unit;	£	15,505.60
b) Luminaire Clean;	£	2,033.33
c) Visual Inspection of luminaire;	£	623.33
d) Visual Inspection of column;	£	470.62
e) Visual Inspection of feeder pillar	£	-
f) Electrical Testing: column and cables	£	3,318.67
g) Electrical Testing: feeder pillar	£	-
h) Structural Testing of column	£	2,355.60
Maintenance costs =	£	24,307.15

Remedial Works

Total repair costs =	£	2,400.00
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Benefits

No. of PICs in past 5 yrs:	23
minus DGNs:	0
Annual accident rate:	4.60
5% of PICs=	0.23
value of acc. savings	£ 43,419.40

£ 188,780.00

(1 kW·h causes 0.20705kg of CO2 2024 Rates)
(2024 CCL Rate 0.00775)

Appendix C

RSE REPORT





National Highways

DMRB TA 501 ROAD SAFETY ENGINEER REPORT

M56 Junction 1 to 6





National Highways

DMRB TA 501 ROAD SAFETY ENGINEER REPORT

M56 Junction 1 to 6

CONFIDENTIAL

PROJECT NO. NH604423

OUR REF. NO. NH604423-WSP-HLG-M56 J1_J6-RP-OS-0001

DATE: MARCH 2025

WSP

First Floor

3 Wellington Place

Leeds

LS1 3AP

WSP.com

CONFIDENTIAL



QUALITY CONTROL

Issue/revision	First issue	Revision 1	Revision 2	Revision 3
Remarks	Confidential			
Date	17 th March 2025			
Prepared by				
Signature				
Checked by				
Signature				
Authorised by				
Signature				
Project number	NH604423			
Report number	NH604423- WSP-HLG-M56 J1_J6-RP-OS- 0001			
File reference	As Above			

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SUMMARY OF PIC DATA FOR THE STUDY AREA

APPENDIX B

PIC LOCATION PLAN

APPENDIX C

ROAD SAFETY EVALUATION OF LIGHTING SCHEMES (NOVEMBER 2022)

1

INTRODUCTION

wsp

1 INTRODUCTION

1.1 GENERAL

- 1.1.1. This Road Safety Engineer (RSE) report sets out the findings and recommendations arising from analysis and evaluation of Personal Injury Collisions (PICs), that have occurred on an 8.3 km long section of the M56 Motorway.
- 1.1.2. The scope of this report is restricted to:
- The M56 mainline carriageway running between J1 and J6, which includes both entry and exit slip roads, beyond the minimum distance required by the "5-second rule," as defined in the Institution of Lighting Professionals (ILP) Professional Lighting Guide (PLG 02),
 - The 0.8km main line carriageway of M56-Northern Spur at junction 3A (to a point where M56 combines into A5103), and
 - The southeast spur of the M56 (Manchester Airport spur) at junction 5 (to Thorley Lane overhead bridge).
- 1.1.3. For clarity, it should be noted that the grade separated circulatory carriageways of all interchanges and conflict areas, fall outside of this study.
- 1.1.4. The scope of this report has been agreed in advance with National Highways (NH) who maintain and manage the country's Motorway network.
- 1.1.5. This report has been prepared in accordance with the requirements and advice contained within the Design Manual for Roads and Bridges (DMRB) document TA 501 'Road Lighting Appraisal'. The purpose of this report is to quantify the potential road safety impacts of removing street lighting from the defined sections / links of the M56 Motorway.
- 1.1.6. The engineers undertaking this assessment have the appropriate training, skills and experience in road safety engineering and collision investigation. This report has been approved by practicing Road Safety Auditor(s) who have undertaken and successfully completed the recognised RoSPA training in road safety.
- 1.1.7. A site visit has not been undertaken to assist with the preparation of this report, and as such, any views expressed within are caveated on that basis.
- 1.1.8. This report supplements the DMRB Road Safety Audit process and therefore the full Road Safety Audit process should be undertaken in accordance with GG 119 'Road Safety Audit'.

1.2 SCHEME DESCRIPTION

- 1.2.1. The length of road under consideration within this RSE report is that of the North Cheshire Motorway (M56), extending from J1 with Kingsway (A34) in Cheadle to J6 with Wilmslow Road. The scheme area terminates at Sunbank Lane overhead bridge. The scheme also encompasses the northern Spur of M56 from J3A till the Princess Parkway (A5103) and the southeast spur of M56 (Manchester Airport spur) from J5 to the Thorley Lane overhead bridge.

1.2.2. Within the study area, the M56 forms part of the Strategic Road Network (SRN) and takes the form of a multi lane, dual carriageway type arrangement. The carriageway arrangement varies between junctions as follows:

- The M56 takes the geometric form of two mainline running lanes in both directions from J1 to J3A with central reserve a hard shoulder arrangement,
- A section of northern spur of M56 till J3 has three mainline running lanes in each direction, also with central reserve a hard shoulder arrangement, and
- Between J3 and J6, the M56 takes the geometric form of four mainline running lanes in both directions with central reserve a hard shoulder arrangement, One lane among these four lanes functions as a lane drop/lane gain at each junction.

1.2.3. It is understood that the M56 is typically subjected to the National Speed Limit (NSL) of 70mph for both the eastbound and westbound carriageways between J3A and J6. However, the section between J1-J3 is subjected to a prescribed speed limit of 50mph. The scheme extents for the study area are demonstrated in Figure 1-1:



Figure 1-1 – M56 J1 to J6 Scheme Extents

1.2.4. The study area is fully lit and includes the following lighting related highway assets between J1 to J6:

- 135no. of 10m, 12m and 18m nominal height road lighting columns with a double bracket and with single bracket arm and lanterns incorporating a 250w, 135w and 400w HPS SON-T lamps across Link 1.
- 84no. of 12m and 15m nominal height road lighting columns with a double bracket arm and with a single bracket arm and lanterns incorporating a 400w and 250w HPS SON-T lamps across the Link 2,

- 99no. of 12m and 15 nominal height road lighting columns with a double bracket arm and with a single bracket arm and lanterns incorporating a 400w and 250w HPS SON-T lamps across Link 3,
 - 107no. of 10m, 12m and 15m nominal height road lighting columns with a double bracket arm and with a single bracket arm and lanterns incorporating a 400w, 250w and 150w HPS SON-T lamps across Link 4, and
 - 151no. of 10m, 12m and 15 nominal height road lighting columns with a double bracket arm and with a single bracket arm and lanterns incorporating a 400w, 250w and 150W HPS SON-T lamps across Link 5.
- 1.2.5. The above-mentioned lighting assets are life-expired and have failed the statutory testing hence, their renewal / removal is required.

1.3 PROPOSALS UNDER CONSIDERATION

- 1.3.1. NH want to consider the road safety impacts of removing historic street lighting within the extents of the M56, between J1 and J6, as detailed in sections above.

2

PERSONAL INJURY COLLISION ANALYSIS



2 PERSONAL INJURY COLLISION ANALYSIS

2.1 GENERAL

- 2.1.1. The following assessment follows the suggested approach as detailed within DMRB guidance document TA 501.
- 2.1.2. Full STATS19 PIC data was provided to the RSEs by the scheme designer, for the period between January 2017 to March 2022 (some 5 years and 3 months). It should be noted that years affected by the COVID19 Pandemic (between March 2020 to 2021) have been included as part of this assessment.
- 2.1.3. The adopted dataset complies with the last 5-year period (3-year minimum) requirement as defined by paragraph 3.1.1 of guidance document TA 501.
- 2.1.4. Within the extents of the study area, a total of 75no. PICs were recorded within the period from January 2017 to March 2022.
- 2.1.5. Of the 75no. recorded PICs:
 - 60no. of PICs were recorded as 'slight' in severity (Category 3 from STATS19),
 - 12no. of PICs were recorded as 'serious' (Category 2 from STATS19) and,
 - 03no. of PICs was recorded as 'fatal' (Category 1 from STATS19).
- 2.1.6. For the purposes of this report, the PIC data is further categorised into five assessment zones:
 - Link 1 - between J1 to J2,
 - Link 2 - between J2 to J3,
 - Link 3 - between J3 to J4,
 - Link 4 - between J4 to J5, and
 - Link 5 - between J5 to J6.
- 2.1.7. A table summarising the recorded PIC incidents is attached at **Appendix A** of this report. The 3no. fatal incidents are highlighted as red text.
- 2.1.8. This assessment does not include the consideration of 'damage only' collision data.

2.2 STUDY AREA – PERSONAL INJURY COLLISIONS

- 2.2.1. The 75no. PICs that occurred within the scheme area are summarised in table overleaf by severity and by link.

Table 2-1 - PICs (by severity) occurring on different links within scheme area.

Severity Condition	No. of PICs which Occurred within Study Area / By Link				
	Link 1	Link 2	Link 3	Link 4	Link 5
Slight	8	10	12	7	23
Serious	1	2	2	1	6
Fatal	1	1	0	1	0
Total	10	13	14	9	29

- 2.2.2. It is noted that the distribution of incidents is consistent between Links 1 and 4 (ranging between 9no. to 14no. PICs per link) however there were 29no. PICs recorded during the study period on Link 5 alone. This is some 38.66% of total incidents, however the majority are noted to be recorded as 'slight in severity'.
- 2.2.3. Findings from a detailed review of all the 75no. recorded PICs shows that the majority of collisions (some 76%) occurred due to 'driver error' rather than any evident geometric issues with the layout of the motorway network. The STATS19 data sheet attributes factors such as:
- Poor turn / manoeuvre (STATS19 contribution factor code: 403),
 - Failure to look properly (STATS19 contribution factor code: 802),
 - Careless, reckless or in a hurry (STATS19 contribution factor code: 602),
 - Failure to judge other persons path or speed (STATS19 contribution factor code: 403),
 - Following too close (STATS19 contribution factor code: 403),
 - Exceeding speed limit (STATS19 contribution factor code: 306)
 - Distraction in vehicle (STATS19 contribution factor code: 509), and
 - Travelling too fast for conditions (STATS19 contribution factor code: 408).
- 2.2.4. The descriptions/contribution factors for rest of the PICs do not provide clear details of the incident and as such it is not possible to comment on these incidents in detail.
- 2.2.5. Reference is also made to the 2no. of incidents (ref: XE052343, XEC61717). As indicated in the STATS19 data, these PICs involve pedestrians. Both of these incidents are discussed in detail in KSI incident section below.
- 2.2.6. With respect to the Killed or Seriously Injured (KSI) incidents, 3no. collisions were recorded as fatal in severity with 12no. collisions were recorded as serious in nature. These 15no. KSI incidents are discussed in detail below.
- 2.2.7. The first recorded fatal collision (ref: XEC61717) occurred on 29th of September 2019, during hours of darkness and on the unlit section of the M56 eastbound carriageway between J1 and J2. The recording of the lighting situation is potentially disputed and is

discussed later within the RSE report. [REDACTED]

- 2.2.8. The second recorded fatal collision (ref: XE076570) occurred on 24th of October 2020 during darkness hours with streetlights present and lit. The weather conditions at the time were recorded as rainy but without winds. [REDACTED]

- 2.2.9. The third recorded fatal collision (ref: XE052343) occurred on 10th of January 2019 during darkness hours with streetlights condition unknown. [REDACTED]

- 2.2.10. The 12no. of serious PICs that occurred within the scheme area can be categorised as:
- First incident (ref: J1084493) occurred on the Link 1 during the daylight,
 - The second and third incidents (ref: XE077543 and XEC60017) occurred on Link 2 in the hours of darkness with streetlights present and lit,
 - Fourth and fifth incidents (ref: A1045514, XEM69179) occurred on Link 3 of which one occurred during the daylight while later occurred during darkness hours with streetlights present and lit.
 - The sixth incident (ref: XEC48263) occurred on Link 4 during the daylight hours.
 - Remaining six incidents (ref: XEJ28678, XEJ47703, XEJ53297, XE078910, XEC50916, XI065785) occurred on Link 5, three of them occurred during daylight hours while 3 occurred during the darkness with streetlights present and lit.

- 2.2.11. Among these 12no. of serious PICs, 11no. of PICs [REDACTED]

- 2.2.12. The single serious incident (ref: XEM69179) can be attributed to the road environment factors involved. The incident occurred on 09th of February 2018 during the hours of darkness with streetlights present and lit. The weather conditions at the time were recorded as rainy but without winds. [REDACTED]

2.2.13.

COLLISION HOTSPOT ANALYSIS

2.2.14. In addition to analysis of individual PICs, this RSE report also considers any 'hotspots' on the road network through collision cluster identification. For the purposes of this report, a collision cluster is defined as:

- Six or more injury collisions (any severity) within 100m of each other or at a junction, in the most recent 3 calendar year period; or,
- Three or more higher severity injury collisions (fatal or serious injuries) within 100m of each other or at a junction, in the most recent 3 calendar year period.

2.2.15. As noted by the PICs plan attached at **Appendix B**, no cluster sites have been identified within the study area.

DARKNESS HOURS COLLISION ANALYSIS.

2.2.16. With respect to the total number of recorded PICs, some 39no. out of the total 75no. incidents are recorded to have occurred during darkness hours. This equates to 52% of all recorded incidents. The darkness hours PICs are listed in Table below.

Table 2-2 - PICs (by Ref) Occurring in Darkness Hours.

Darkness: Streetlights present and lit	Darkness: Streetlights present but unlit	Darkness: No Streetlighting	Darkness: Streetlighting unknown
Link 1 (J1 - J2)			
J1025896	N/A	XEC61717	N/A
XEC39995			
XEC67294			
XJM68313			
Link 2 (J2 - J3)			
A1052642	N/A	19100104244	N/A
XE052483			
XE077543			
XEC36198			
A1151971			

XE076570			
XE077104			
XEC29635			
XEC60017			
Link 3 (J3 - J4)			
A1134540	N/A	N/A	N/A
XE052182			
XE052187			
XE076934			
XEJ52176			
XEM69179			
Link 4 (J4 - J5)			
XIC40610	N/A	N/A	XE052343
XIC45450			
Link 5 (J5 - J6)			
A1135334	XEA77798	CC17385992	XEC59758
XA065213		XEJ44059	
XE078910			
XEC40611			
XEC49073			
XEC50916			
XEJ37008			
XEJ52023			
XEJ58081			
XEM68285			
XI065785			

- 2.2.17. Among these 39no. of PICs that occurred within the scheme area during the hours of darkness, 7no. of PICs are related to the KSI incidents including 3no. of fatalities while remaining 32no. of incidents were recorded slight in severity.
- 2.2.18. It should be noted that 4no. PICS (Ref: XEC61717, 19100104244, CC17385992 and XEJ44059) are recorded to have occurred on parts of the M56 network which were unlit, i.e. during darkness conditions with no streetlights present. It is the understanding of the RSEs however that the network has been fully street lit since 1990. This has been confirmed by the scheme designer and as such it is reasonable to assume that the STATS19 data is recorded in error. For the purposes of this report these 4no. incidents have been categorised as occurring in the presence of street lighting.

- 2.2.19. DMRB Standard TA 501 states that '*...the PICs shall be rationalised to exclude anywhere DGN was a significant contributory factor*'. [REDACTED]

- 2.2.20. Reference has been made to the STATS19 data, and it is considered that out of the 75no. total PICs that occurred, 2no. recorded incidents occurred due to [REDACTED].
- 2.2.21. The two recorded [REDACTED] collisions (ref: A1052642 and A1109346) can be attributed to [REDACTED] Both incidents occurred within Link 2 and are independent of each other (with respect to location). Of the 2no. of incidents, first incident occurred in the darkness hours where streetlights were present and lit while the other occurred during daylight.
- 2.2.22. It is considered therefore that the 2no. of identified [REDACTED] PICs (of which 1no. PICs occurred during the hours of darkness) should be discounted for the purposes of this assessment.

SUMMARY

- 2.2.23. If the 2no. of the identified [REDACTED] incidents are excluded, out of the total of 75no. PICs within the extents of the study area, this leaves 73no. PICs which were not considered to be attributable to Driver Gross Negligence.
- 2.2.24. Of the remaining 73no. of PICs, a total of 38no. of PICs occurred during the hours of darkness (i.e. 39no. total darkness incidents minus those evaluated as being [REDACTED]). This equates to some 52.05% of all PICs.
- 2.2.25. The 73no. PICs are further divided for each individual link by lighting conditions, as shown in the table overleaf:

Table 2-3 - Summary of PICs with lighting conditions, across two links of scheme area

Lighting Condition	Link 1	Link 2	Link 3	Link 4	Link 5
Daylight	5	2	8	6	14
Darkness- Streetlights present and lit	5	9	6	2	14
Darkness- Streetlights present but unlit	0	0	0	0	0
Darkness- Street lighting unknown	0	0	0	1	1
Total no. of PICs	10	11	14	9	29

2.3 NATIONAL DATA

'Reported road casualties in Great Britain: Annual report'

- 2.3.1. The DfT document 'Reported Road casualties in Great Britain: annual report' has been adopted for this RSE. This is the most up to date available data set from the DfT (at the time of writing) and it indicates that on UK all-purpose dual carriageways (including both unlit and lit roads), 68% of PICs occurred during daylight hours.
- 2.3.2. Some 32% of PICs on all-purpose dual carriageways occurred during the hours of darkness (of which 23% occurred on lit roads with the lights on, 1% occurred on lit roads with the lighting unlit, 6% occurred on unlit roads and 2% occurred on roads where the lighting provision was unknown). The DfT data is summarised in Table 2-4.

Table 2-4 – 'Reported road casualties in Great Britain annual report' for collisions occurring in different light Conditions

Lighting conditions	Reported road accident in Great Britain – Dual Carriageways	
Daylight	68%	
Darkness - lights lit	23%	32%
Darkness - lights unlit	1%	
Darkness - no lighting	6%	
Darkness - unknown lighting provision	2%	
Total		100%

- 2.3.3. The comparison between the rate of collisions that have occurred within the scheme area and the national average, is shown in the table below:

Table 2-5 - Scheme area collision rate comparison with National average

Lighting conditions	Reported road accident in Great Britain – Dual Carriageways	Link 1	Link 2	Link 3	Link 4	Link 5
Daylight	68%	50%	18%	57%	67%	48%
Darkness – lights present and lit	23%	50%	82%	43%	22%	48%
Darkness - lights present but unlit	1%	0%	0%	0%	0%	0%
Darkness - no lighting	6%	0%	0%	0%	0%	0%
Darkness - unknown lighting provision	2%	0%	0%	0%	11%	4%
Total	100%	100%	100%	100%	100%	100%

Note: Values rounded.

2.3.4. The comparison shows that darkness collisions on all Links, under each lighting condition, are significantly higher than the national average rate except Link 4, where the darkness collisions in the presence of lighting are consistent with the national average. However, it is acknowledged that the study area had a limited sample size of recorded PICs when categorised in separate links, making a direct comparison between the two data sets of limited value. Reference should be made to Table 2-3 which summarises 'true' number of PICs which have occurred within the study area.

2.3.5. Unfortunately, it is not possible to obtain a percentage darkness PIC saving from the 'Reported Road casualties in Great Britain annual report' as this document does not include details of the lengths of road and traffic flows subject to collisions. An additional comparison is therefore required.

TA 49/07 - Appraisal of New and Replacement Lighting on the Strategic Motorway and All-Purpose Trunk Road Network

2.3.6. As it is not possible to estimate a PIC saving using the 'Reported road casualties in Great Britain annual report' document, a sensitivity test has been undertaken. Firstly, this report adopts the assumption that the street lighting within the study area is currently providing a 10% saving in PICs. The 10% figure has been based on the figure for 'All Purpose Dual Carriageway links' identified in Table 1 in the now superseded DMRB Advice Note TA 49/07.

Mott MacDonald Report 'Road Safety Evaluation of Lighting Schemes' (November 2022)

2.3.7. Secondly, this report refers to the Mott MacDonald (MM) study (Doc ref: 406395GB-TPN-HTS-190-B) undertaken in November 2022. The MM study evaluated the road safety

performance of six ‘...road lighting switch-off schemes’ on motorway mainline sections of the Connect Plus Services (CPS) network. The MM study is attached at **Appendix C**.

- 2.3.8. Based on the analysis of data at the 6 sites, the MM study concludes that the lighting switch-off schemes did not result in an increase, in the rate of night-time collisions. Furthermore, for the majority of the scheme sites, the MM study states that there was also little evidence to suggest that lighting switch-off increased the severity of casualties occurring at night, based on KSI and FWI rates.
- 2.3.9. Following a review of this study, an average 5% darkness PIC saving for renewing road lighting on a link / junction has been adopted. This is based upon an average value of the TA 49/07 estimate (10%) and the MM Study estimate (0%).

PREDICTED PIC SAVING CALCULATIONS:

- 2.3.10. Clause 6.15 provides the following method for calculating the predicted PIC saving in the opening year for renewing lighting on a lit link or junction:

‘...The predicted PIC saving shall be calculated by multiplying the number of opening year darkness PICs by Equation 6.15, where A is the appropriate percentage determined by the road safety engineer’.

Equation 6.15 (Predicted PIC Savings)

$$A / (100\% - A)$$

The resultant PIC figure relates to lit conditions and, therefore, it can be assumed that the collision savings determined by the road safety engineer are already being achieved. The formula takes account of this fact’.

- 2.3.11. Using the sensitivity test figure of a 5% PIC saving for dual carriageway links and the opening year average darkness PIC values for lit conditions, the Predicted PIC savings can be calculated in accordance with Clauses 6.6 and 6.15 of the TA501 document as:

Table 2-6 – Calculation of Predicted PIC Savings.

Lighting condition – Streetlights present	Darkness PICs	Study Period (Years)	Avg. Darkness PICs per Year	Adopted PIC Saving Value	Calculated PIC Savings per Year.
Link 1	5	5.3	0.94	5%	0.050
Link 2	9	5.3	1.70	5%	0.089
Link 3	6	5.3	1.13	5%	0.060
Link 4	2	5.3	0.38	5%	0.020
Link 5	14	5.3	2.64	5%	0.139

- 2.3.12. Based on the TA 501 methods as mentioned in Clause 6.15, and assuming a 5% PIC reduction due to street lighting, the presence of lighting is estimated to prevent



approximately 0.050 PICs per year on Link 1. This equates to one darkness PIC every 20 years.

- 2.3.13. Similarly, for the Link 2, lighting is expected to reduce PICs by approximately 0.089 per year, or one darkness PIC every 11 years.
- 2.3.14. Also, for the Link 3, lighting is expected to reduce PICs by approximately 0.060 per year. This equates to one darkness PIC every 17 years.
- 2.3.15. For the Link 4, lighting is expected to reduce PICs by approximately 0.020 per year, This equates to a single darkness PIC every 50 years.
- 2.3.16. Similarly, for the Link 5, lighting is expected to reduce PICs by approximately 0.139 per year, or one darkness PIC every 7 years.

3

SUMMARY



3 SUMMARY

3.1.1. In summary:

- There was a total of 75 PICs recorded within the M56 study area (J1 to J6),
- The analysed data set was for a 5.3-year period between January 2017 to March 2022,
- The PICs occurring during COVID years have been included in this assessment,
- Of the 75 recorded PICs, 60 PICs were recorded as 'slight' in severity (Category 3 from STATS19), 12 PICs were recorded as 'serious' (Category 2 from STATS19) and, 03 PICs was recorded as 'fatal' (Category 1 from STATS19) during the period between January 2017 to March 2022,
- Study area is divided into five links i.e. Link 1 (J1-J2) and Link 2 (J2-J3), Link 3 (J3-J4), Link 4 (J4-J5) and Link 5 (J5-J6),
- The 75no total incidents can be further categorised into Links as:
 - 10no. of PICs out of 75no. of PICs occurred on Link 1,
 - 13no. of PICs out of 75no. of PICs occurred on Link 2,
 - 14no. of PICs out of 75no. of PICs occurred on Link 3,
 - 09no. of PICs out of 75no. of PICs occurred on Link 4, and
 - 29no. of PICs out of 75no. of PICs occurred on Link 5.
- The majority of collisions among these 75 incidents (76% of total) are considered to be the result of driver error which according to accident statics sheet can be attributed as 'following to close, reckless / in a hurry, failure to look properly or failure to judge other persons path or speed, failure to stop at time, poor turn or manoeuvres, careless, reckless or in a hurry, exceeding speed limit and distraction in vehicle,
- With respect to potential Collision Clusters, no hotspots have been spotted within the study area,
- With respect to the total number of recorded PICs, a total of 39 out of 75 incidents, are recorded to have occurred during darkness hours. This equates to 52 % of all recorded incidents.
- For the four recorded incidents on the M56 that were listed as occurring in unlit conditions, review of the network indicates that it has been fully lit since 1990. This is likely a data error, and the incidents (for the purposes of a robust assessment) have been categorized as occurring under street lighting,
- A total of 02 collisions were considered to be the result of Driver Gross Negligence (DGN) and have been discounted / removed from the dataset. Both of these incidents occurred on Link 2. Of the 02 DGN incidents, single incident occurred during the hours of darkness,
- This leaves 73no.of non DGN PICs, of which a total of 38no. of PICs occurred during the hours of darkness. This equates to some 52.05% of all PICs,
- Following the approach outlined in the TA501 standard document, street lighting is estimated to save 0.050 PICs per year on Link 1 (1 darkness PICs every 20 years), 0.089 PICs per year on Link 2 (1 darkness PICs every 11 years), 0.060 PICs per year on Link 3 (1 darkness PICs every 17 years), 0.020 PICs per year on Link 4 (1 darkness



PICs every 50 years) and 0.139 PICs per year on Link 5 (1 darkness PICs every 7 years), assuming the PIC saving value of 5%.

Appendix A

SUMMARY OF PIC DATA FOR THE STUDY AREA



Table 1 - Summary of PIC Data

Link 1 (J1-J2)					
No.	Reference	Severity	Date	Time	Lighting Conditions
1	J1025896	Slight	02-Mar-2021	00:57	Dark: streetlights present and lit
2	J1078683	Slight	27-Jul-2021	15:30	Daylight
3	J1084493	Serious	03-Sep-2021	14:23	Daylight
4	XE058921	Slight	10-Jul-2019	08:30	Daylight
5	XE059182	Slight	18-Jul-2019	07:54	Daylight
6	XEC39995	Slight	23-Jan-2018	18:35	Dark: streetlights present and lit
7	XEC61717	Fatal	20-Sep-2019	01:10	Dark: no street lighting
8	XEC67294	Slight	08-Jan-2020	17:15	Dark: streetlights present and lit
9	XJM26133	Slight	18-Jan-2017	16:10	Daylight
10	XJM68313	Slight	20-Jan-2020	07:12	Dark: streetlights present and lit
Link 2 (J2-J3)					
No.	Reference	Severity	Date	Time	Lighting Conditions
1	A1052642	Slight	05-Jun-2021	21:30	Dark: streetlights present and lit
2	XE052483	Slight	04-Jan-2019	23:50	Dark: streetlights present and lit
3	XE077543	Serious	15-Nov-2020	18:05	Dark: streetlights present and lit
4	XEC36198	Slight	19-Oct-2017	04:55	Dark: streetlights present and lit
5	19100104244	Slight	11-Mar-2019	21:12	Dark: no street lighting
6	A1109346	Slight	12-Nov-2021	09:00	Daylight
7	A1151971	Slight	10-Mar-2022	00:10	Dark: streetlights present and lit
8	E4073118	Slight	15-Jul-2020	15:30	Daylight
9	XE076570	Fatal	24-Oct-2020	21:45	Dark: streetlights present and lit
10	XE077104	Slight	09-Nov-2020	18:15	Dark: streetlights present and lit
11	XEC29635	Slight	10-Mar-2017	23:05	Dark: streetlights present and lit
12	XEC44055	Slight	21-May-2018	16:10	Daylight

13	XEC60017	Serious	04-Aug-2019	00:15	Dark: streetlights present and lit
Link 3 (J3-J4)					
No.	Reference	Severity	Date	Time	Lighting Conditions
1	A1045514	Serious	30-Apr-2021	18:24	Daylight
2	A1078208	Slight	17-Aug-2021	15:15	Daylight
3	A1115265	Slight	29-Nov-2021	07:30	Daylight
4	A1134540	Slight	09-Dec-2021	22:45	Dark: streetlights present and lit
5	XE035108	Slight	31-Aug-2017	13:05	Daylight
6	XE052182	Slight	05-Jan-2019	18:15	Dark: streetlights present and lit
7	XE052187	Slight	09-Jan-2019	17:00	Dark: streetlights present and lit
8	XE076934	Slight	04-Nov-2020	18:50	Dark: streetlights present and lit
9	XEJ30904	Slight	10-May-2017	17:57	Daylight
10	XEJ52176	Slight	04-Jan-2019	07:00	Dark: streetlights present and lit
11	XEJ54472	Slight	12-Mar-2019	09:22	Daylight
12	XEJ57406	Slight	30-May-2019	04:40	Daylight
13	XEM69179	Serious	24-Feb-2020	06:00	Dark: streetlights present and lit
14	XEP32920	Slight	17-Jul-2017	17:30	Daylight
Link 4 (J4-J5)					
No.	Reference	Severity	Date	Time	Lighting Conditions
1	XE041953	Slight	26-Mar-2018	16:45	Daylight
2	XE052343	Fatal	10-Jan-2019	19:35	Dark: street lighting unknown
3	XE070809	Slight	20-Apr-2020	12:30	Daylight
4	XEC48263	Serious	17-Sep-2018	17:20	Daylight
5	XEC49097	Slight	12-Oct-2018	15:20	Daylight
6	XIC40610	Slight	13-Feb-2018	20:04	Dark: streetlights present and lit
7	XIC45450	Slight	28-Jun-2018	22:20	Dark: streetlights present and lit
8	XIE61550	Slight	10-Sep-2019	18:00	Daylight
9	XIJ31611	Slight	14-Jun-2017	15:40	Daylight

Link 5 (J5-J6)

No.	Reference	Severity	Date	Time	Lighting Conditions
1	A1039825	Slight	20-Apr-2021	0842	Daylight
2	A1065843	Slight	13-Jul-2021	1448	Daylight
3	A1072112	Slight	30-Jul-2021	1148	Daylight
4	A1111097	Slight	15-Nov-2021	1557	Daylight
5	A1135334	Slight	29-Nov-2021	1745	Dark: streetlights present and lit
6	CC17385992	Slight	30-Nov-2017	1612	Dark: no street lighting
7	E2M26613	Slight	26-Jan-2017	0958	Daylight
8	XA065213	Slight	03-Dec-2019	1625	Dark: streetlights present and lit
9	XE078910	Serious	06-Jan-2021	1952	Dark: streetlights present and lit
10	XEA77798	Slight	03-Dec-2020	1855	Dark: streetlights present but unlit
11	XEC38004	Slight	01-Dec-2017	1439	Daylight
12	XEC39705	Slight	11-Jan-2018	1430	Daylight
13	XEC40611	Slight	13-Feb-2018	1835	Dark: streetlights present and lit
14	XEC49073	Slight	10-Oct-2018	1910	Dark: streetlights present and lit
15	XEC50916	Serious	28-Nov-2018	0720	Dark: streetlights present and lit
16	XEC59036	Slight	02-Jul-2019	0715	Daylight
17	XEC59758	Slight	09-Jul-2019	0001	Dark: street lighting unknown
18	XEJ28678	Serious	21-Mar-2017	1250	Daylight
19	XEJ32978	Slight	18-Jul-2017	0700	Daylight
20	XEJ37008	Slight	08-Nov-2017	1853	Dark: streetlights present and lit
21	XEJ44059	Slight	24-May-2018	2315	Dark: no street lighting
22	XEJ47703	Serious	20-Aug-2018	1141	Daylight
23	XEJ52023	Slight	03-Jan-2019	2221	Dark: streetlights present and lit
24	XEJ53297	Serious	08-Feb-2019	1515	Daylight



25	XEJ58081	Slight	14-Jun-2019	2215	Dark: streetlights present and lit
26	XEJ60806	Slight	21-Aug-2019	1205	Daylight
27	XEM68285	Slight	04-Feb-2020	0200	Dark: streetlights present and lit
28	XI065785	Serious	13-Dec-2019	0300	Dark: streetlights present and lit
29	XMC62149	Slight	28-Sep-2019	1450	Daylight

Appendix B

PIC LOCATION PLAN



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Key:

- Serious
- Slight
- Fatal
- Search Area
- XXXX
XXXX Accident Ref ID.

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Cheshire WA3 7WD
Web www.highwaysengland.co.uk

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Revision	By	Checked	Approved	Date		Description

Project
M56 J1 to J6

Sheet 1 of 4

Drawing
Accident Locations

Data Parameters:
01/01/17 - 31/12/22

Requested by: SP	Date: 03/11/23
Drawn by: JR	Date: 07/11/23
Authorised by: N/A	Date:
Drawing No.	Revision 0
Drawing Scale: NTS	Plot Scale: NTS

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Key:

- Serious
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Revision	By	Checked	Approved	Date	Description

Project
M56 J1 to J6

Sheet 3 of 4

Drawing
Accident Locations

Data Parameters:
01/01/17 - 31/12/22

Requested by: SP	Date: 03/11/23
Drawn by: JR	Date: 07/11/23
Authorised by: N/A	Date:
Drawing No.	Revision 0
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Revision	By	Checked	Approved	Date		Description

Project
M56 J1 to J6

Sheet 4 of 4

Drawing
Accident Locations

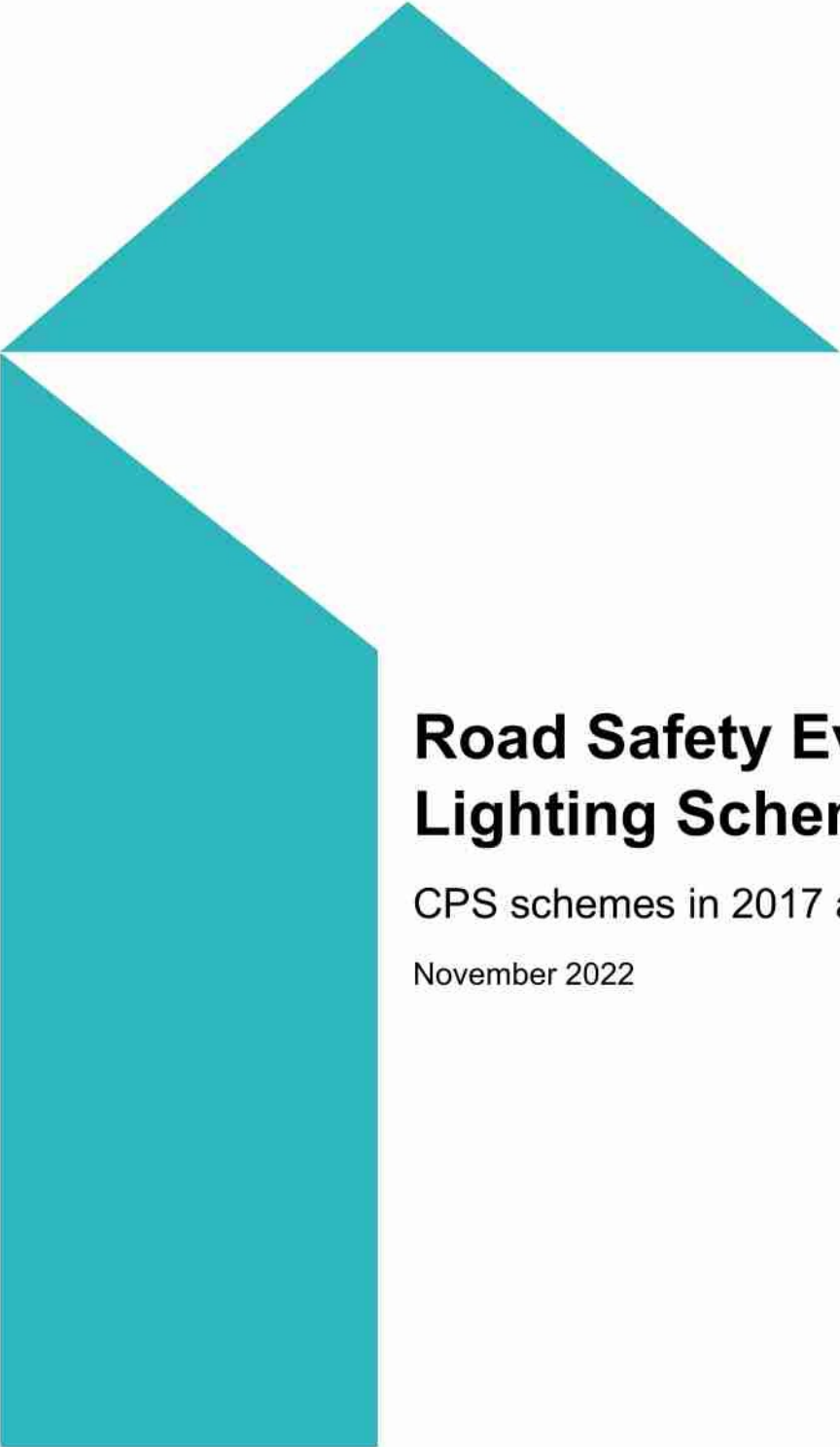
Data Parameters:
01/01/17 - 31/12/22

Requested by: SP	Date: 03/11/23
Drawn by: JR	Date: 07/11/23
Authorised by: N/A	Date:
Drawing No.	Revision 0
Drawing Scale: NTS	Plot Scale: NTS



Appendix C

ROAD SAFETY EVALUATION OF LIGHTING SCHEMES (NOVEMBER 2022)



Road Safety Evaluation of Lighting Schemes

CPS schemes in 2017 and 2018

November 2022

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Mott MacDonald
4th Floor
Mountbatten House
Grosvenor Square
Southampton SO15 2JU
United Kingdom

T +44 (0)23 8062 8800
mottmac.com

Connect Plus Services
Leatherhead Motorway
Compound
Bypass Road
Leatherhead
Surrey KT22 7GZ

Road Safety Evaluation of Lighting Schemes

CPS schemes in 2017 and 2018

November 2022

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Executive Summary

Mott MacDonald has been commissioned by Connect Plus Services (CPS) to undertake a road safety evaluation of a number of road lighting switch-off schemes, in order to determine the effect on recorded personal injury collision (PIC) occurrences, before and after switch-off.

Traditionally, it has been assumed that road lighting schemes on motorways may reduce night-time collisions by up to 10%, as stated in previous design standards and national guidance, which are now withdrawn (**Chapter 1**).

Six sites have been identified by CPS for this road safety evaluation. It is understood that all of the schemes identified, this involved the switch-off of road lighting, throughout their extents, on mainline carriageway sections only (**Chapter 2**).

PIC and traffic flow data has been used to calculate night-time collision, fatal and weighted injury (FWI) and killed or seriously injured (KSI) casualty rates, for periods spanning three years before and after the schemes were implemented (**Chapter 3**).

Based on the analysis of data at these sites, it is concluded that the lighting switch-off schemes have not resulted in an increase in the rate of night-time collisions. Furthermore, for the majority of the scheme sites, there was also little evidence to suggest that lighting switch-off has increased the severity of casualties occurring at night, based on KSI and FWI rates (**Chapter 4**).

However, it should be noted that the analysis calculations do not take into account any other mitigation measures, such the installation of temporary traffic signing to advise motorists that there is no road lighting, improvements to road markings, replacement of road studs etc.

Due to the small sample size of the data for each site and the fact that the 'after' period spans the period of the Covid-19 pandemic, it is recommended that further validation and analysis of these and other lighting scheme sites is undertaken, once a five-year dataset becomes available.

1 Introduction

Mott MacDonald has been commissioned by Connect Plus Services (CPS) to undertake a road safety evaluation of a number of road lighting switch-off schemes, in order to determine the effect on recorded personal injury collision (PIC) occurrences, before and after switch-off.

1.1 Background

This road safety evaluation has been undertaken in order to assist CPS and its suppliers, when conducting future Road Lighting Appraisals (in accordance with DMRB TA 501) for similar projects, specifically, when having to apply estimated collision savings that road lighting switch-off may provide following completion.

Traditionally, it has been assumed that road lighting schemes on motorways may reduce night-time collisions by up to 10% as last stated in previous design standards¹ and national guidance², which are now withdrawn. It is understood that the safety benefit of lighting switch-off schemes is currently under review in the road lighting industry, principally through an update of the Design Manual for Roads and Bridges (DMRB) TA 501 Road lighting appraisal document.

1.2 Outline of report

The report is divided into the following chapters:

- **Chapter 2** explains the methodology used to analyse the collision data and traffic statistics.
- **Chapter 3** presents the results of the PIC data and traffic count data analysis for each site.
- **Chapter 4** evaluates and provides conclusions about the road safety performance of each scheme site.
- **Chapter 5** contains a glossary of terms used in the report.
- **Chapter 6** lists the references to information relating to the evaluation.
- **Appendix A** contains the data used for calculations.
- **Appendix B** contains location key plans showing each area analysed.

¹ TA 49/07 (Withdrawn) Appraisal of New and Replacement Lighting

² IAN 167/12 (Withdrawn) Guidance for the Removal of Road Lighting

2 Methodology

2.1 Site selection

Six sites have been selected by CPS for this road safety evaluation. It is understood that all of the schemes involved the switch-off of road lighting, throughout their extents, on mainline carriageway sections only. The details of each site location have been summarised in **Table 2.1** below:

Table 2.1: Lighting switch-off scheme site details

Site ref	Location	Type	Extents (MP)	Scheme date	Description
001	A1(M) J2 to J3	D2M	MP 28-9 to MP 31-2	01/10/2018	Road lighting switch-off (mainline only) + temporary traffic signing installed to advise motorists of no lighting while lighting was switched-off and kept in place until lighting was removed.
002	M1 J3 to J4	D3M	MP 19-2 to MP 22-0	01/10/2018	Road lighting switch-off (mainline only) + temporary traffic signing installed to advise motorists of no lighting while lighting was switched-off and kept in place until lighting was removed.
003	M1 J4 to J5	D3M	MP 22-2 to MP 25-5	01/10/2018	Road lighting switch-off (mainline only) + temporary traffic signing installed to advise motorists of no lighting while lighting was switched-off and kept in place until lighting was removed.
004	M1 J5 to J6a	D3M	MP 29-0 to MP 33-0	01/10/2018	Road lighting switch-off (mainline only) + temporary traffic signing installed to advise motorists of no lighting while lighting was switched-off and kept in place until lighting was removed.
005	A2 (A2018 to M25)	D3AP	MP 23-2 to MP 28-5	01/09/2017	Road lighting switch-off (mainline only) + temporary traffic signing installed to advise motorists of no lighting while lighting was switched-off and kept in place until lighting was removed.
006	M3 J1	D3M	MP 24-0 to MP 25-2	01/09/2017	Road lighting switch-off (mainline only) + temporary traffic signing installed to advise motorists of no lighting while lighting was switched-off and kept in place until lighting was removed.

Source: Scheme details provided by CPS

2.2 Collision data source

'STATS19' Personal Injury Collision (PIC) data has been obtained and analysed for this report.

These statistics refer to collisions on public roads which became known to the police. Figures for deaths refer to people who sustained injuries which caused death less than 30 days after the road collision.

The PIC data for the evaluation of the six scheme sites has been provided by CPS. It is understood that, as network operator, CPS are provided with a copy of the relevant police data for their own analysis and road safety monitoring purposes.

2.3 Collision data analysis

This evaluation report presents the results of the analysis for the latest three-years of PIC data, 'before' and 'after' the switch off of each road lighting scheme.

The scheme switch-off dates vary between each site, as indicated by CPS, previously listed in **Table 2.1**. It is understood that for Site refs: 001, 002, 003 and 004, road lighting switch-off was undertaken during September 2018, but for the purposes of this analysis the three-year 'after' period starts from 01/10/2018.

Table 2.2, below, shows the three-year 'before' and 'after' lighting switch-off analysis period, by scheme:

Table 2.2: 'Before' and 'After' lighting switch-off analysis periods, by site

Site refs	3-year period 'before'		3-year period 'after'	
	From	To	From	To
001, 002, 003 & 004	01/10/2015	30/09/2018	01/10/2018	30/09/2021
005 & 006	01/09/2014	31/08/2017	01/09/2017	31/08/2020

Source: Based on scheme implementation dates provided by CPS

The PIC analysis of each site has been completed using the KeyACCIDENT (v7.11) software package. The PIC data searches have been conducted within defined analysis areas, which represent each individual scheme site, provided as a marker post range.

Using OS mapping, an area has been drawn around the scheme site for the mainline carriageway only (typically, an offset polygon by 25m on each side of a drawn centreline). Records that were not considered to be within the extents of the lighting switch-off scheme (i.e., those recorded on slip roads, local roads, roundabouts and interchanges etc) have been manually removed from the dataset.

PIC records where 'driver gross negligence' (DGN) has been indicated have also been removed from the datasets. DGN records are considered to be collisions listed with one or more of the following data fields:

- Accident: Impaired by alcohol (Driver / Rider – Impairment) [Contributory Factor 501]
- Accident: Impaired by drugs (Driver / Rider – Impairment) [Contributory Factor 502]
- Accident: Vehicle in course of crime (Special codes) [Contributory Factor 902]
- Vehicle: Breath Test = 1 Positive
- Vehicle: Stolen = 1 Stolen

Only collisions occurring at night-time have been used for the analysis. The PIC data has been filtered by lighting conditions (Accident: Lighting Conditions IN LIST 4,5,6,7) to determine the collisions that occurred during the hours of darkness.

2.4 Traffic flow information

Traffic flow information has been obtained from the 'WebTRIS' Traffic Information database website (National Highways, 2022) at <http://webtris.highwaysengland.co.uk/>

Annual average daily traffic (AADT) volumes from counters (in both carriageway directions) located at each scheme site have been extracted, using a three-year period 'before' and 'after' scheme completion, based on whole calendar years.

For all sites, the following rationale has been used when retrieving traffic count data:

- 'Before' lighting switch-off: Average daily flows between 01/01/2015 and 31/12/2017
- 'After' lighting switch-off: Average daily flows between 01/01/2019 and 31/12/2021

Using the 'Daily report' function, average night-time traffic counts (between 22:00hrs and 06:00hrs) have been determined for both the 'before' and 'after' scheme implementation periods.

2.5 Collision rate calculations

Using the appropriate three years of 'before' and 'after' PIC data and traffic flow datasets, it has been possible to calculate annual collision rates for each scheme.

Collision rates have been calculated by dividing the number of dark PICs by the annual total vehicle miles travelled (between 22:00hrs and 06:00hrs) at each site. This is expressed as units of PICs per hundred million vehicle miles travelled (PICs / hmvm).

2.6 Killed or seriously injured (KSI) rate calculations

In order to determine any changes in the severity of injuries that occurred following switch-off for each scheme, dark 'killed or seriously injured' (KSI) casualties have been analysed.

A KSI rate has been calculated for each scheme site by dividing the number of dark KSI casualties by the annual total vehicle miles travelled (between 22:00hrs and 06:00hrs). This is expressed as units of KSI per hundred million vehicle miles travelled (KSI / hmvm).

2.7 Fatal and weighted injury (FWI) rate calculations

Using the 'fatal and weighted injury' (FWI) method, a value has also been applied to each reported casualty, according to their severity classification. FWI is defined as: (number of fatalities) + 0.1 x (number of serious casualties) + 0.01 x (number of slight casualties).

By dividing the number of dark FWI casualties by the annual total vehicle miles travelled (between 22:00hrs and 06:00hrs) at each site, a night-time FWI rate is calculated. This is expressed as units of FWI per hundred million vehicle miles travelled (FWI / hmvm).

2.8 Impact of travel restrictions during 2020 and 2021

It should be noted that the Covid-19 pandemic, and associated travel restrictions imposed by the UK Government, impacted on the national 2020 and 2021 road safety statistics. Overall, it is recognised that there were significantly less traffic volumes and road traffic collisions reported during these periods:

“Motor vehicle traffic on Great Britain motorways did increase by 14.4% between 2020 and 2021. However, traffic in 2021 was 14.5% lower compared to 2019 pre-pandemic levels³.”

“As the first half of 2021 also had a lockdown, the overall figures for 2021 remain lower than pre-pandemic levels. Over the second half of the year, both casualties and traffic returned to levels similar to those in 2019. Monthly changes in casualties during 2021 generally showed a similar trend to changes in motor vehicle traffic levels⁴.”

Similar variations in the total number of collisions reported have been seen in the datasets analysed for this evaluation. As a consequence, the focus of this study has been limited to rates (collision rate, KSI rate and FWI rate), rather than totals of PICs and casualties, in order to provide comparable statistics for the 'before' and 'after' road lighting switch-off periods, which are based on the amount of traffic recorded at the time (as described previously in **Chapter 2.4**).

³ Road Traffic Estimates: Great Britain 2021

⁴ Reported road casualties Great Britain, annual report: 2021

3 Analysis

3.1 Site 001 – A1(M) J2 to J3

This scheme involved the switch-off of existing road lighting throughout the mainline carriageway between MP 28-9 to MP 31-2 on 01/10/2018.

In total, there were nine collisions reported at the site in the six-year analysis period. These PICs resulted in 18 casualties, all of which were recorded as slight in severity.

A summary of the 'before' and 'after' scheme analysis is provided in **Table 3.1** below:

Table 3.1: Analysis of night-time collisions at Site 001

A1(M) J2 to J3 D2M	Dark PICs and casualties		Traffic	Length	Collision rate	KSI casualty rate	FWI rate
	Dark PICs	Dark KSI casualties	Night time ave traffic	(miles)	Night time PICs / hmvm	Night time KSIs / hmvm	Night time FWI / hmvm
Before	2	0	6,800	1.4	19.2	0.0	0.6
After	1	0	5,583	1.4	11.7	0.0	0.1
diff (+/-)	-1	-	-1,217	-	-7.5 (↓39.1%)	-	-0.5

Source: Mott MacDonald

For the three-year period 'before' the lighting switch-off scheme, there were two collisions that had occurred during the hours of darkness, accounting for 40% of the total PICs recorded before lighting was switched-off. Night-time traffic accounted for approximately 9% of the total AADT.

In the three years 'after' the scheme was implemented, the number of recorded PICs decreased from two to one, which represents 25% of the total collisions. Night-time traffic also decreased to approximately 8% of the total daily volume.

The calculated collision rates indicate that there was a **39% decrease** in night-time PICs / hmvm at this site since the lighting was switched-off on the mainline carriageway.

There were no fatal or seriously injured casualties reported 'before' or 'after' the completion of the scheme, and therefore the KSI rate has remained unchanged at 0.0.

The calculated FWI rate has also seen a decrease from 0.6 to 0.1 after the scheme was implemented.

3.2 Site 002 – M1 J3 to J4

This scheme involved the switch-off of existing road lighting throughout the mainline carriageway between MP 19-2 to MP 22-0 on 01/10/2018.

In total, there were 13 collisions reported at the site in the six-year analysis period. These resulted in 18 casualties, of which two were recorded as serious and 16 slight in severity. No fatalities were reported.

A summary of the 'before' and 'after' scheme analysis is provided in **Table 3.2** below:

Table 3.2: Analysis of night-time collisions at Site 002

M1 J3 to J4 D3M	Dark PICs and casualties		Traffic	Length	Collision rate	KSI casualty rate	FWI rate
	Dark PICs	Dark KSI casualties	Night time ave traffic	(miles)	Night time PICs / hmv	Night time KSIs / hmv	Night time FWI / hmv
Before	3	1	9,173	1.7	17.6	5.9	0.8
After	2	0	8,131	1.7	13.2	0.0	0.1
diff (+/-)	-1	-1	-1,043	-	-4.4 (↓24.8%)	-5.9	-0.6

Source: Mott MacDonald

For the three-year period 'before' the lighting switch-off scheme, there were three collisions that had occurred during the hours of darkness, accounting for 30% of the total PICs recorded before lighting was switched-off. Night-time traffic accounted for approximately 12% of the total AADT.

In the three years 'after' the scheme was implemented, the number of recorded collisions decreased from three to two PICs, which represented 67% of the total. Night-time traffic also decreased to approximately 12% of the daily total.

The calculated collision rates indicate that there was a **25% decrease** in night-time PICs / hmv at this site following the lighting switched-off on the mainline carriageway.

The severity rate reduced from 5.9 to 0.0 KSIs / hmv. Only one serious casualty was reported in the 'before' period.

The calculated FWI rate has also seen a decrease from 0.8 to 0.1, following scheme switch off.

3.3 Site 003 – M1 J4 to J5

This scheme involved the switch-off of existing road lighting throughout the mainline carriageway between MP 22-2 to MP 25-5 on 01/10/2018.

In total, there were 22 collisions reported at the site in the six-year analysis period. These resulted in 44 casualties, of which four were recorded as serious and 40 of slight severity. No fatalities were reported.

A summary of the 'before' and 'after' scheme analysis is provided in **Table 3.3** below:

Table 3.3: Analysis of night-time collisions at Site 003

M1 J4 to J5 D3M	Dark PICs and casualties		Traffic	Length	Collision rate	KSI casualty rate	FWI rate
	Dark PICs	Dark KSI casualties	Night time ave traffic	(miles)	Night time PICs / hmvvm	Night time KSIs / hmvvm	Night time FWI / hmvvm
Before	6	1	13,586	2.1	19.2	3.2	0.7
After	4	0	11,241	2.1	16.0	0.0	0.4
diff (+/-)	-2	-1	-2,345	-	-3.2 (↓16.6%)	-3.2	-0.3

Source: Mott MacDonald

For the three-year period 'before' the lighting switch-off scheme, there were six collisions that had occurred during the hours of darkness, accounting for 43% of the total PICs recorded before lighting was switched-off. Night-time traffic accounted for approximately 14% of the total AADT.

In the three years 'after' the scheme was implemented, the number of recorded collisions decreased from six to four PIC, which represented 50% of the total. Night-time traffic also decreased to approximately 12% of the total.

The calculated collision rates indicate a **17% decrease** in night-time PICs / hmvvm at this site, following the lighting switch-off on the mainline carriageway.

The KSI rate reduced from 5.9 to 0.0. Only one serious casualty was reported in the 'before' period. However, there were no fatalities recorded, and only one seriously injured casualty reported in the 'before' period.

The calculated FWI rate has also seen a decrease from 0.7 to 0.4 after lighting was switched off.

3.4 Site 004 – M1 J5 to J6a

This scheme involved the switch-off of existing road lighting throughout the mainline carriageway between MP 29-0 to MP 33-0 on 01/10/2018.

In total, there were 47 collisions reported at the site in the six-year analysis period. These resulted in 75 casualties, of which 10 were recorded as serious and 65 slight in severity. No fatalities were reported.

A summary of the 'before' and 'after' scheme analysis is provided in **Table 3.4** below:

Table 3.4: Analysis of night-time collisions at Site 004

M1 J5 to J6a D3M	Dark PICs and casualties		Traffic	Length	Collision rate	KSI casualty rate	FWI rate
	Dark PICs	Dark KSI casualties	Night time ave traffic	(miles)	Night time PICs / hmv	Night time KSIs / hmv	Night time FWI / hmv
Before	7	2	9,793	2.5	26.1	7.5	1.0
After	5	0	9,087	2.5	20.1	0.0	0.3
diff (+/-)	-2	-2	-706	-	6.0 (↓23.0%)	-7.5	0.7

Source: Mott MacDonald

For the three-year period 'before' the lighting switch-off scheme, there were seven collisions that had occurred during the hours of darkness, accounting for 28% of the total PICs recorded before lighting was switched-off. Night-time traffic accounted for approximately 12% of the total AADT.

In the three years 'after' lighting was switched off, the number of recorded collisions decreased from seven to five PICs, which represents 23% of the total. Night-time traffic also decreased to approximately 13% of the total.

The calculated collision rates indicate that there was a **23% decrease** in night-time PICs / hmv at this site, following the lighting switch-off on the mainline carriageway.

The severity rate reduced from 7.5 to 0.0 KSIs / hmv. Only one serious casualty was reported in the 'before' period. However, it should be noted that there were no fatalities recorded and only two seriously injured casualties reported in the 'before' period.

The calculated FWI rate has also seen a decrease from 1.0 to 0.3 after the scheme was implemented.

3.5 Site 005 – A2 (A2018 to M25)

This scheme involved the switch-off of existing road lighting throughout the mainline carriageway between MP 23-2 to MP 28-5 on 01/09/2017.

In total, there were 118 collisions reported at the site in the six-year analysis period. These resulted in 168 casualties, of which two were fatal, 15 serious and 151 slight in severity.

A summary of the 'before' and 'after' scheme analysis is provided in **Table 3.5** below:

Table 3.5: Analysis of night-time collisions at Site 005

A2 (A2018 to M25) D3AP	Dark PICs and casualties		Traffic	Length	Collision rate	KSI casualty rate	FWI rate
	Dark PICs	Dark KSI casualties	Night time ave traffic	(miles)	Night time PICs / hmvvm	Night time KSIs / hmvvm	Night time FWI / hmvvm
Before	26	5	12,379	3.3	58.1	11.2	3.8
After	15	1	10,702	3.3	38.8	2.6	3.2
diff (+/-)	-11	-4	-1,676	-	-19.3 (↓33.3%)	-8.6	0.6

Source: Mott MacDonald

For the three-year period 'before' the lighting switch-off scheme, there were 26 collisions that had occurred during the hours of darkness, accounting for 34% of the total PICs recorded before lighting was switched-off. Night-time traffic accounted for approximately 11% of the total AADT.

In the three years 'after' the scheme was implemented, the number of recorded collisions decreased from 26 to 15 PICs, which represents 56% of the total. Night-time traffic also decreased to approximately 10% of the total daily volume.

The calculated collision rates indicate that there was a **33% decrease** in night-time PICs / hmvvm at this site following lighting switch-off on the mainline carriageway.

The KSI rate reduced from 11.2 to 2.6. There was one fatality recorded in both the 'before' and 'after' scheme periods. Four serious casualties were reported in the 'before' period, but none were recorded in the 'after' period.

The calculated FWI rate has also seen a decrease from 3.8 to 3.2 after lighting was switched off.

3.6 Site 006 – M3 J1

This scheme involved the switch-off of existing road lighting throughout the mainline carriageway between MP 24-0 to MP 25-2 on 01/09/2017.

In total, there were three collisions reported at the site in the three-year period 'before' and 'after' the scheme was implemented. No killed or seriously injured (KSI) casualties were recorded in the six-year period.

A summary of the 'before' and 'after' scheme analysis is provided in **Table 3.6** below:

Table 3.6: Analysis of night-time collisions at Site 006

M3 J1 D3M	Dark PICs and casualties		Traffic	Length	Collision rate	KSI casualty rate	FWI rate
	Dark PICs	Dark KSI casualties	Night time ave traffic	(miles)	Night time PICs / hmv	Night time KSIs / hmv	Night time FWI / hmv
Before	0	0	4,576	0.7	0	0.0	0
After	1	0	3,237	0.7	40.3	0.0	0.4
diff (+/-)	+1	-	-1,339	-	+40.3 (↑100%)	-	0.4

Source: Mott MacDonald

For the three-year period 'before' the lighting switch-off scheme, there were no collisions recorded during the hours of darkness. Night-time traffic accounted for approximately 7% of the total AADT.

In the three years 'after' the scheme was implemented, one slight collision was recorded. The night-time traffic also decreased, representing approximately 6% of the daily total.

The calculated collision rates indicate that there was a **100% increase** in night-time PICs / hmv at this site since the lighting was switched-off on the mainline carriageway; as there were no previous dark collisions recorded during the 'before' period.

There were no fatal or seriously injured casualties reported 'before' or 'after' the completion of the scheme, and therefore the KSI rate has remained unchanged at 0.0.

The calculated FWI rate has therefore also seen an increase from 0 to 0.4 after lighting was switched off.

4 Evaluation

4.1 Summary of analysis

The change to collision and FWI rates for each lighting switch-off scheme, following implementation are summarised by site, in **Table 4.1** below.

Table 4.1: Scheme evaluation summary, by site

Site ref	Type	Collision rate	KSI rate	FWI rate
		Night time PICs / hmvm	Night time KSIs / hmvm	Night time FWI / hmvm
001	D2M	Decrease (↓39.1%)	No change	Decrease
002	D3M	Decrease (↓24.8%)	Decrease	Decrease
003	D3M	Decrease (↓16.6%)	Decrease	Decrease
004	D3M	Decrease (↓23.0%)	Decrease	Decrease
005	D3AP	Decrease (↓33.3%)	Decrease	Decrease
006	D3M	Increase (↑100%)	No change	Increase

Source: Mott MacDonald

Only one site (Site 006) exhibits an increase in the night-time collision and FWI rates following switch off. However, it should be noted that there were no dark collisions recorded in the 'before' analysis period.

The analysis of the road lighting switch-off scheme sites has shown that:

- The lighting switch-off scheme undertaken on the D2M motorway (Site 001) has resulted in a **39% reduction** in night-time collisions. There was no increase in the severity of casualties reported.
- On average, the lighting switch-off schemes implemented on D3M motorways (Sites 002, 003 and 004) has resulted in a **22% reduction** in night-time collisions. One scheme (Site 006) did exhibit an increase in the severity of casualties following lighting switch-off.
- The lighting switch-off scheme undertaken on the D3AP trunk A-road (Site 005) has resulted in a **33% reduction** in night-time collisions. The severity of reported casualties has also reduced.

4.2 Conclusion

Based on the analysis of data at these sites, it is concluded that the lighting switch-off schemes have not resulted in an increase to the rate of night-time collisions.

Furthermore, for the majority of the scheme sites, there was also little evidence to suggest that lighting switch-off has increased the severity of casualties occurring at night, based on KSI and FWI rates.

However, it should be noted that the analysis calculations do not take into account any other mitigation measures, such the installation of new temporary traffic signing to advise motorists that there is no road lighting, improvements to road markings, replacement of road studs etc.

Due to the small sample size of the data for each site and the fact that the 'after' period spans the period of the Covid-19 pandemic, it is recommended that further validation and analysis of these and other lighting scheme sites is undertaken, once a five-year dataset becomes available.

5 Glossary of Terms

AADT	Annual average daily traffic
Cas	Casualty
CPS	Connect Plus Services
D2M	Dualled two-lane motorway with hard shoulder
D3M	Dualled three-lane motorway with hard shoulder
D3AP	Dualled three-lane all-purpose trunk A road
DfT	Department for Transport
DGN	Driver gross negligence
diff (+/-)	Difference (above or below)
DMRB	Design Manual for Roads and Bridges
FWI	Fatal and weighted injury
hmv	Hundred million (100,000,000) vehicle miles travelled
hrs	Hours (time)
KSI	Killed or seriously injured (casualty)
MP	Marker post
OS	Ordnance Survey [mapping]
OSGR	Ordnance Survey grid reference
PIC	Personal injury collision
ref	Reference
SRN	Strategic Road Network
STATS19	Statement of administrative sources (Police collision reporting form)

6 References

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A. Calculations

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A.1 Collision (PIC) and casualty (Cas) data, by site

PICs	Before (DGNs removed)			After (DGNs removed)		
	Total PICs	PICs in dark	% dark PICs	Total PICs	PICs in dark	% dark PICs
Site 001	5	2	40.0%	4	1	25.0%
Site 002	10	3	30.0%	3	2	66.7%
Site 003	14	6	42.9%	8	4	50.0%
Site 004	25	7	28.0%	22	5	22.7%
Site 005	76	26	34.2%	27	15	55.6%
Site 006	2	0	0.0%	1	1	100.0%

Cas	Before (DGNs removed)			After (DGNs removed)			Six year period
	Total Cas	Cas in dark	% dark Cas	Total Cas	Cas in dark	% dark Cas	Total Cas
Site 001	13	6	46.2%	5	1	20.0%	18
Site 002	14	4	28.6%	5	2	40.0%	19
Site 003	23	12	52.2%	21	10	47.6%	44
Site 004	40	10	25.0%	35	8	22.9%	75
Site 005	103	35	34.0%	65	25	38.5%	168
Site 006	2	0	0.0%	1	1	100.0%	3

Source: Mott MacDonald

A.2 Dark KSI casualties, by site

Killed or Seriously Injured Casualties (KSIs) in the dark

	Before (DGNs removed)							After (DGNs removed)							Difference (Before to After)	
	Fatal	Serious	Slight	KSI total	Total	KSI %	FWI*	Fatal	Serious	Slight	KSI total	Total	KSI %	FWI*	% change	Ratio change (%)
Site 001	0	0	6	0	6	0.0%	0.06	0	0	1	0	1	0.0%	0.01	0.0	-83.3
Site 002	0	1	3	1	4	25.0%	0.13	0	0	2	0	2	0.0%	0.02	-100.0	-84.6
Site 003	0	1	11	1	12	8.3%	0.21	0	0	10	0	10	0.0%	0.1	-100.0	-52.4
Site 004	0	2	8	2	10	20.0%	0.28	0	0	8	0	8	0.0%	0.08	-100.0	-71.4
Site 005	1	4	30	5	35	14.3%	1.7	1	0	24	1	25	4.0%	1.24	-72.0	-27.1
Site 006	0	0	0	0	0	0.0%	0	0	0	1	0	1	0.0%	0.01	0.0	0.0

*Fatal and weighted injury (FWI) casualties is defined as: (number of fatalities) + 0.1 x (number of serious casualties) + 0.01 x (number of slight casualties)

Source: Mott MacDonald

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A.3 Site 001 calculation data – A1(M) J2 to J3

Site 001	PICs			Casualties								Traffic data			Route length	Collision rate	KSI casualty rate	FWI rate
				Cas	Dark Cas							Northbound count site: 30360676 Southbound count site: 118012201						
	ALL PICs	Dark PICs	% dark PICs		ALL Cas	Fa	Se	Sl	Total	KSI cas	FWI Cas	ALL AADT	Night time ave traffic	% Night time traffic	(miles)	Night time PICs/HMVM	Night time KSIs/HMVM	Night time FWI/HMVM
D2M	ALL PICs	Dark PICs	% dark PICs	ALL Cas														
Total (6yr periods)	9	3	33%	18	0	0	7	7	0	0.07	146503	12383	8.5%	1.4				
Before (3yr periods)	5	2	40%	13	0	0	6	6	0	0.06	79236	6800	8.6%	1.4	19.19	0.00	0.5	
After (3yr periods)	4	1	25%	5	0	0	1	1	0	0.01	67267	5583	8.3%	1.4	11.68	0.00	0.1	
Difference (No.)		-1									-11970	-1217	-0.003		-7.50	0.00	-0.4	
Difference (%)		50.0									15.1	17.9	3.5		39.10	0.00	79.7	

Source: Mott MacDonald

A.4 Site 002 calculation data – M1 J3 to J4

Site 002	PICs			Casualties							Traffic data			Route length	Collision rate	KSI casualty rate	FWI rate
				Cas	Dark Cas						Northbound count site: 199111903 Southbound count site: 123013101						
	ALL PICs	Dark PICs	% dark PICs		ALL Cas	Fa	Se	Sl	Total	KSI cas	FWI Cas	ALL AADT	Night time ave traffic	% Night time traffic			
	D3M	ALL PICs	Dark PICs	% dark PICs	ALL Cas	Fa	Se	Sl	Total	KSI cas	FWI Cas	ALL AADT	Night time ave traffic	% Night time traffic	(miles)	Night time PICs/HMVM	Night time KSIs/HMVM
Total (6yr periods)	13	5	38%	19	0	1	5	6	1	0.15	146489	17304	11.8%	1.7			
Before (3yr periods)	10	3	30%	14	0	1	3	4	1	0.13	77052	9173	11.9%	1.7	17.57	5.86	0.76
After (3yr periods)	3	2	67%	5	0	0	2	2	0	0.02	69437	8131	11.7%	1.7	13.21	0.00	0.13
Difference (No.)		-1									-7616	-1043	-0.002		-4.35	-5.86	-0.63
Difference (%)		33.3									9.9	11.4	1.6		24.79	100.00	82.64

Source: Mott MacDonald

A.5 Site 003 calculation data – M1 J4 to J5

Site 003	PICs			Casualties							Traffic data			Route length	Collision rate	KSI casualty rate	FWI rate
				Cas	Dark Cas						Northbound count site: 108024801 Southbound count site: 199111802						
	ALL PICs	Dark PICs	% dark PICs		ALL Cas	Fa	Se	SI	Total	KSI cas	FWI Cas	ALL AADT	Night time ave traffic	% Night time traffic	(miles)	Night time PICs/HMVM	Night time KSIs/HMVM
D3M	ALL PICs	Dark PICs	% dark PICs	ALL Cas	Fa	Se	SI	Total	KSI cas	FWI Cas	ALL AADT	Night time ave traffic	% Night time traffic	(miles)	Night time PICs/HMVM	Night time KSIs/HMVM	Night time FWI/HMVM
Total (6yr periods)	22	10	45%	44	0	1	21	22	1	0.31	190023	24826	13.1%	2.1			
Before (3yr periods)	14	6	43%	23	0	1	11	12	1	0.21	97185	13586	14.0%	2.1	19.21	3.20	0.67
After (3yr periods)	8	4	50%	21	0	0	10	10	0	0.1	92838	11241	12.1%	2.1	16.01	0.00	0.40
Difference (No.)		-2									-4348	-2345	-0.019		-3.19	-3.20	-0.27
Difference (%)		33.3									4.5	17.3	13.4		16.63	100.00	40.45

Source: Mott MacDonald

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A.6 Site 004 calculation data – M1 J5 to J6a

Site 004	PICs & Casualties			Casualties							Traffic data			Route length	Collision rate	KSI casualty rate	FWI rate
				Cas	Dark Cas						Northbound count site: 108024602 Southbound count site: 108023701						
	ALL PICs	Dark PICs	% dark PICs	ALL Cas	Fa	Se	SI	Total	KSI cas	FWI Cas	ALL AADT	Night time ave traffic	% Night time traffic	(miles)	Night time PICs/HMVM	Night time KSIs/HMVM	Night time FWI/HMVM
D3M																	
Total (6yr periods)	47	12	26%	75	0	2	16	18	2	0.36	150327	18880	12.6%	2.5			
Before (3yr periods)	25	7	28%	40	0	2	8	10	2	0.28	79468	9793	12.3%	2.5	26.11	7.46	1.04
After (3yr periods)	22	5	23%	35	0	0	8	8	0	0.08	70859	9087	12.8%	2.5	20.10	0.00	0.32
Difference (No.)		-2									-8608	-706	0.005		-6.01	-7.46	-0.72
Difference (%)		28.6									10.8	7.2	-4.1		23.02	100.00	69.21

Source: Mott MacDonald

A.7 Site 005 calculation data – A2 (A2018 to M25)

Site 005	PICs & Casualties			Casualties							Traffic data			Route length	Collision rate	KSI casualty rate	FWI rate
				Cas	Dark Cas						Northbound count site: 30360515 Southbound count site: 30360514						
	ALL PICs	Dark PICs	% dark PICs	ALL Cas	Fa	Se	Sl	Total	KSI cas	FWI Cas	ALL AADT	Night time ave traffic	% Night time traffic	(miles)	Night time PICs/HMVM	Night time KSIs/HMVM	Night time FWI/HMVM
D3AP																	
Total (6yr periods)	118	41	35%	168	2	4	54	60	6	2.94	218742	23081	10.6%	3.3			
Before (3yr periods)	76	26	34%	103	1	4	30	35	5	1.7	113932	12379	10.9%	3.3	58.13	11.18	3.80
After (3yr periods)	42	15	36%	65	1	0	24	25	1	1.24	104810	10702	10.2%	3.3	38.79	2.59	3.21
Difference (No.)		-11									-9122	-1676	-0.007		-19.34	-8.59	-0.59
Difference (%)		42.3									8.0	13.5	6.0		33.27	76.87	15.63

Source: Mott MacDonald

A.8 Site 006 calculation data – M3 J1

Site 006	PICs & Casualties			Casualties							Traffic data			Route length	Collision rate	KSI casualty rate	FWI rate	
				Cas	Dark Cas						Northbound count site: 30360590 Southbound count site: 30360589							
	ALL PICs	Dark PICs	% dark PICs		ALL Cas	Fa	Se	SI	Total	KSI cas	FWI Cas	ALL AADT	Night time ave traffic	% Night time traffic	(miles)	Night time PICs/HMVM	Night time KSIs/HMVM	Night time FWI/HMVM
D3M																		
Total (6yr periods)	3	1	33%		3	0	0	1	1	0	0.01	114255	7814	6.8%	0.7			
Before (3yr periods)	2	0	0%		2	0	0	0	0	0	0	63271	4576	7.2%	0.7	0.00	0.00	
After (3yr periods)	1	1	100%		1	0	0	1	1	0	0.01	50984	3237	6.3%	0.7	40.30	0.00	
Difference (No.)		1										-12287	-1339	-0.009		40.30	0.00	0.40
Difference (%)		100.0										-24.1	-41.4	-13.9		100.00	0.00	100.00

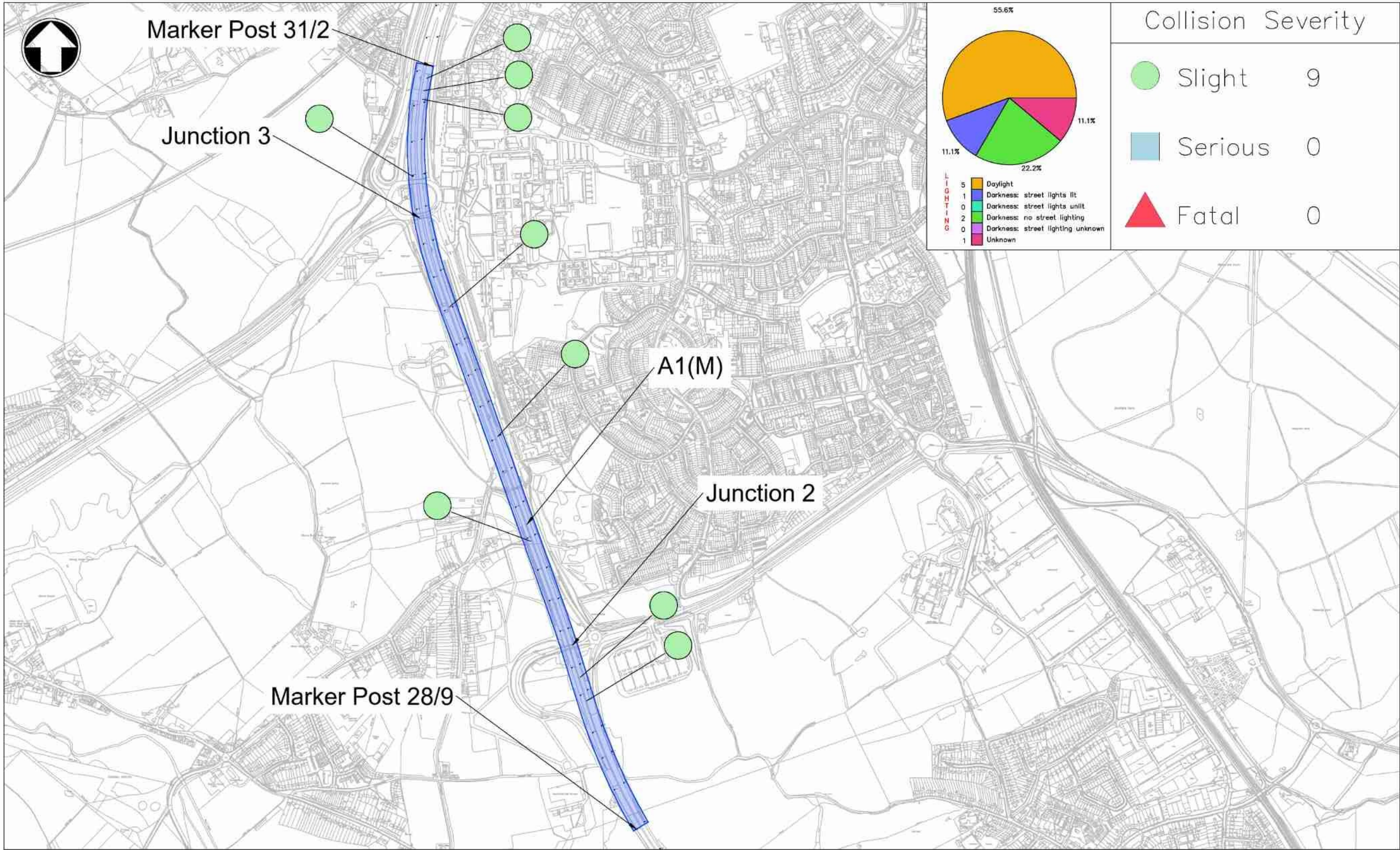
Source: Mott MacDonald

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B. Location Plots

B.1	Site 001 location plot – A1(M) J2 to J3	25
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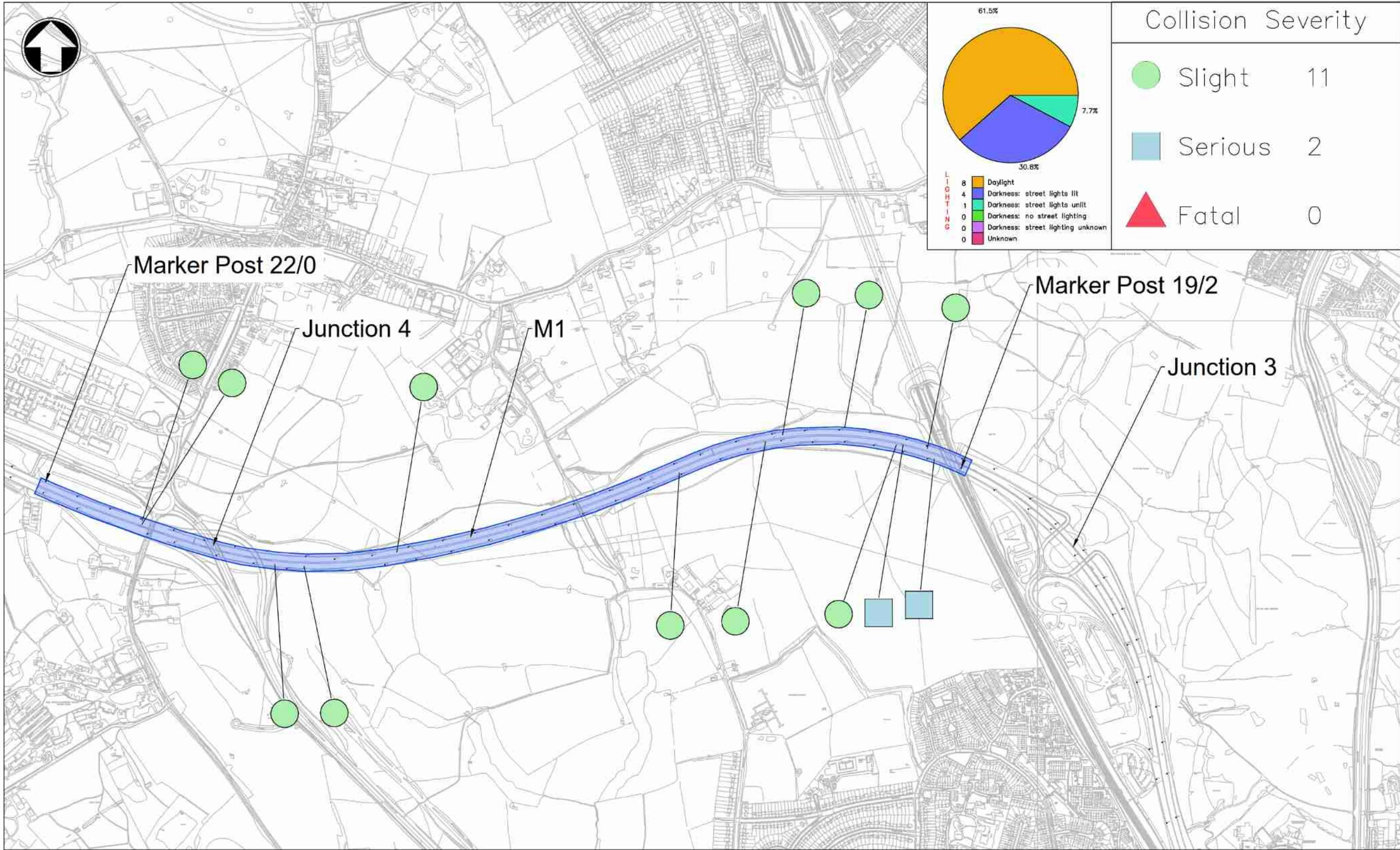
B.1 Site 001 location plot – A1(M) J2 to J3



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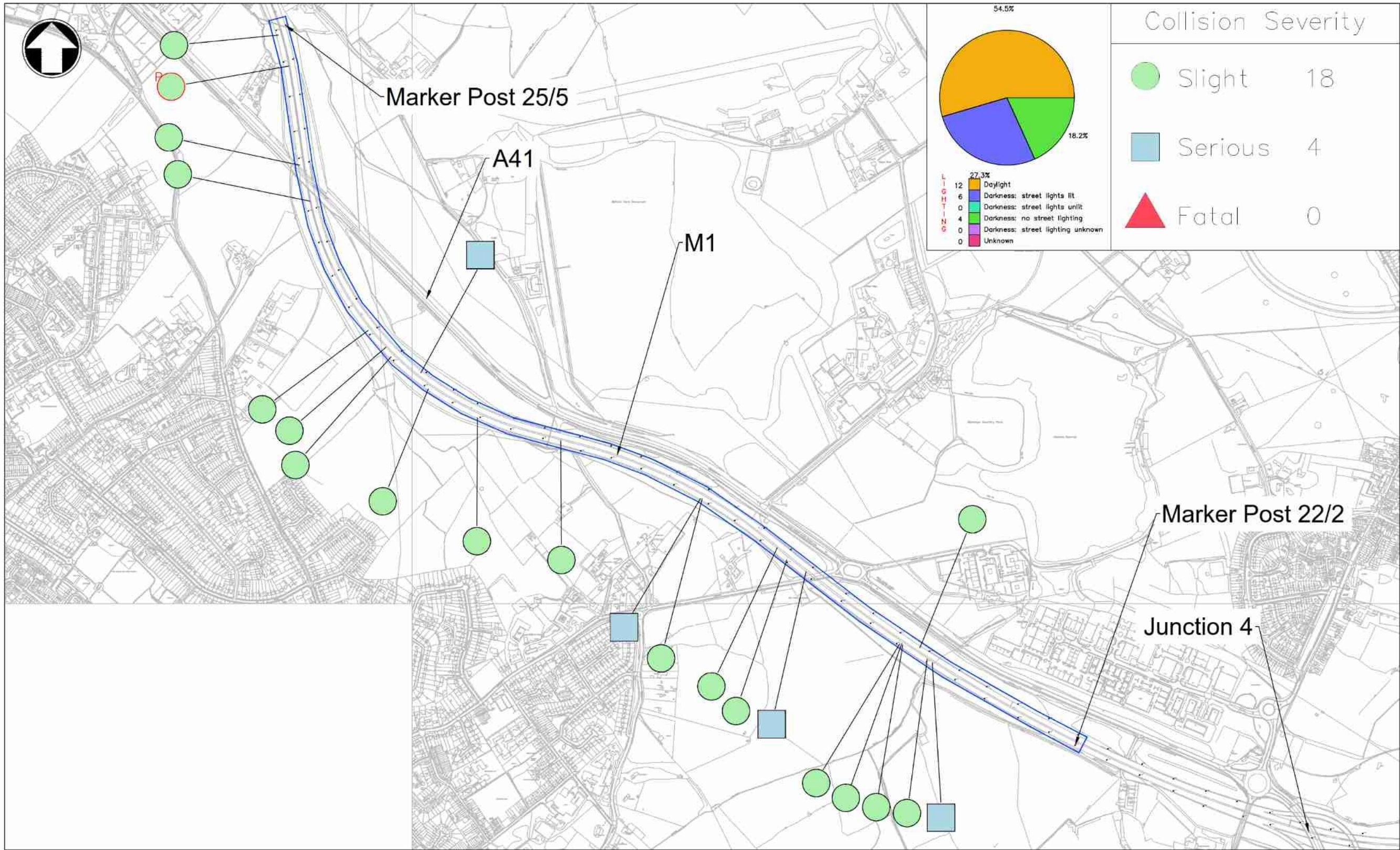
B.2 Site 002 location plot – M1 J3 to J4



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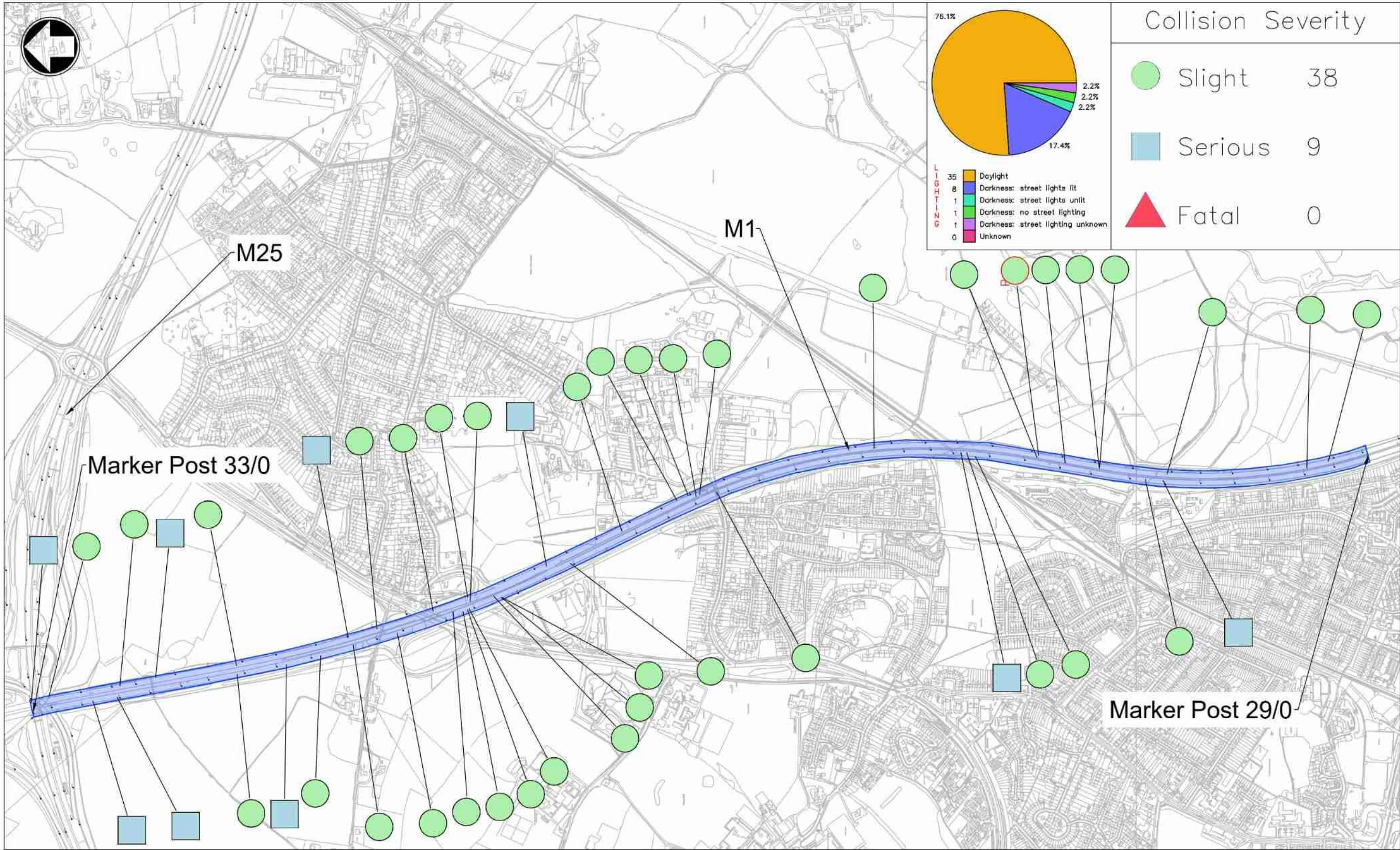
B.3 Site 003 location plot – M1 J4 to J5



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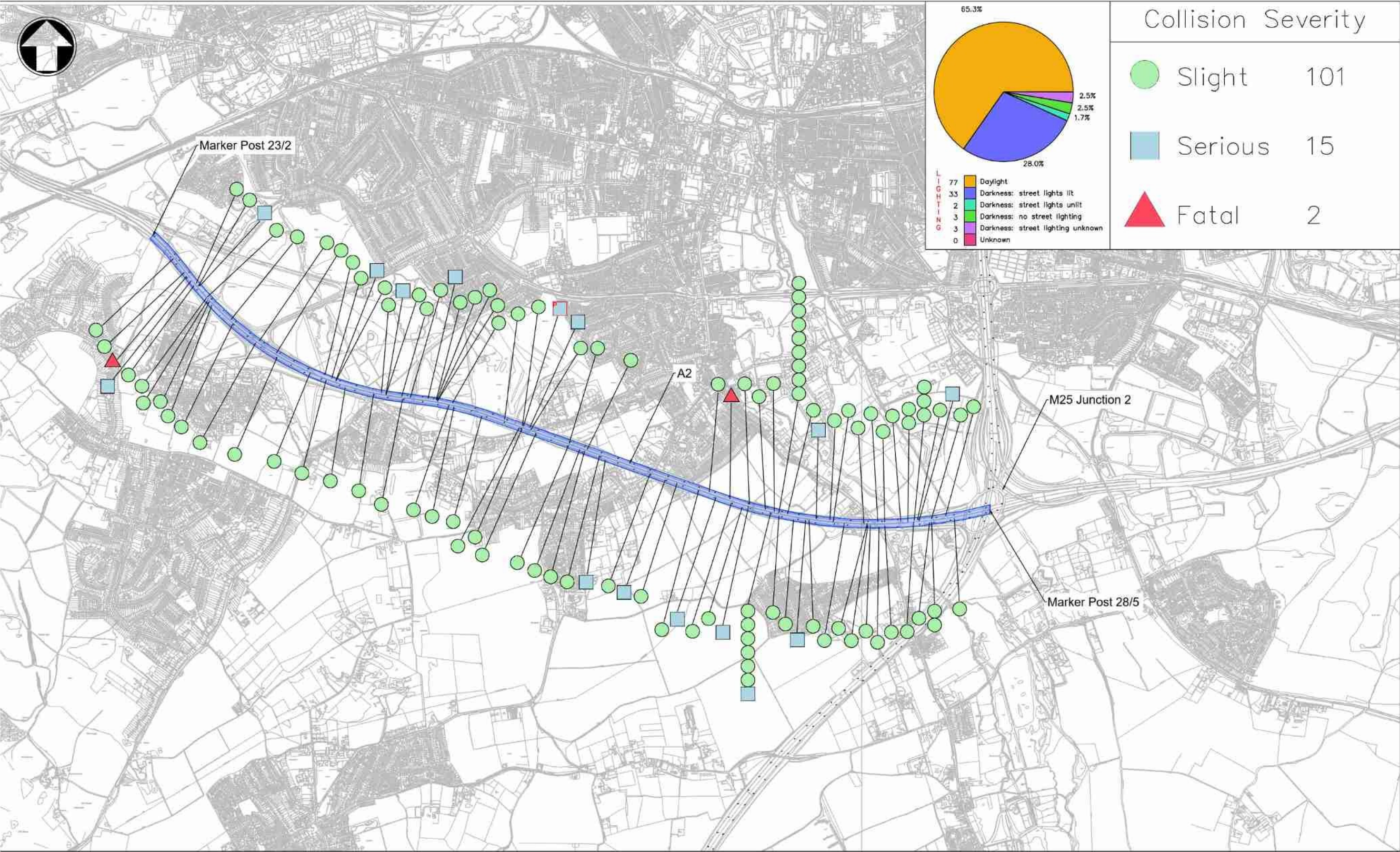
B.4 Site 004 location plot – M1 J5 to J6a



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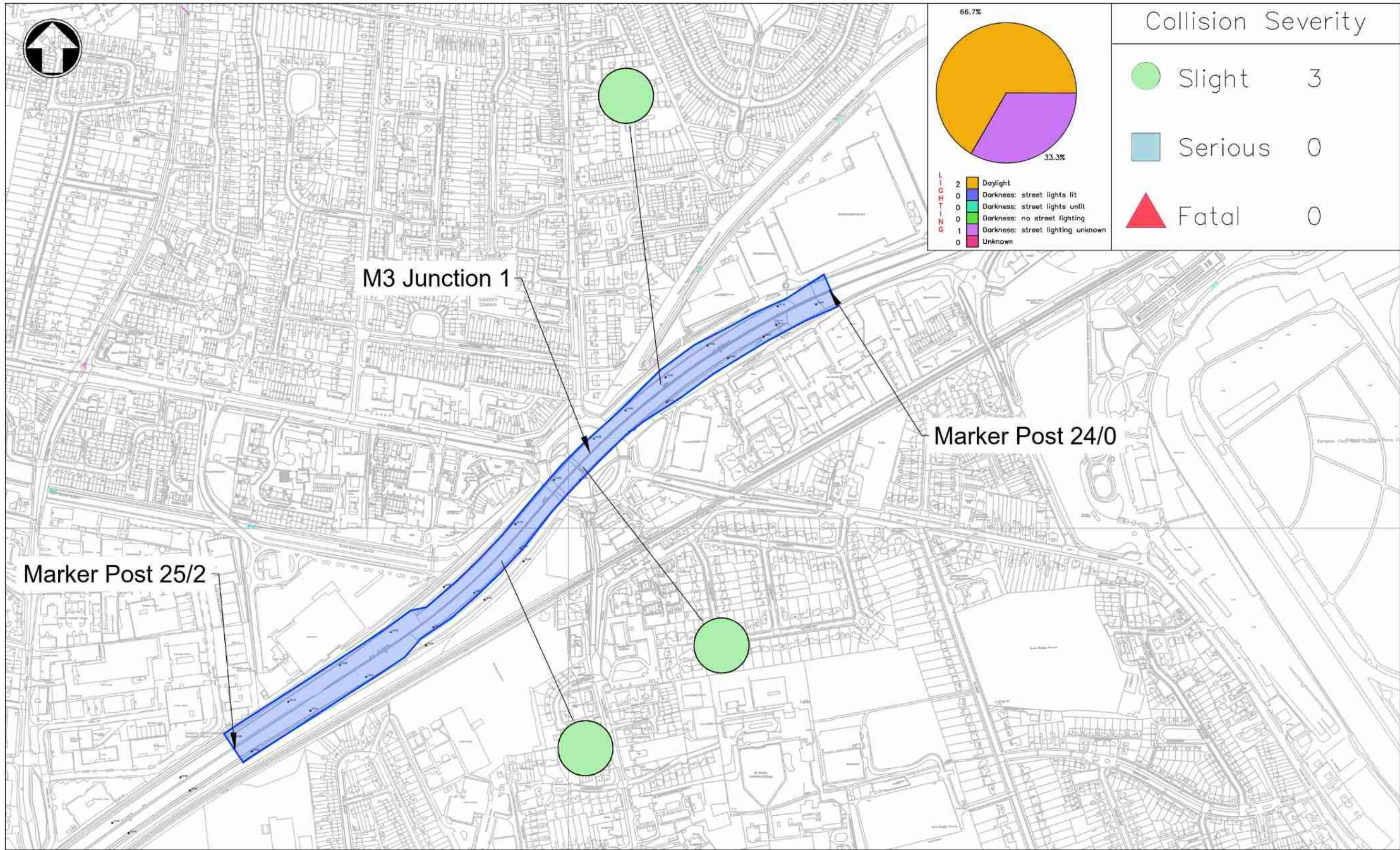
B.5 Site 005 location plot – A2 (A2018 to M25)



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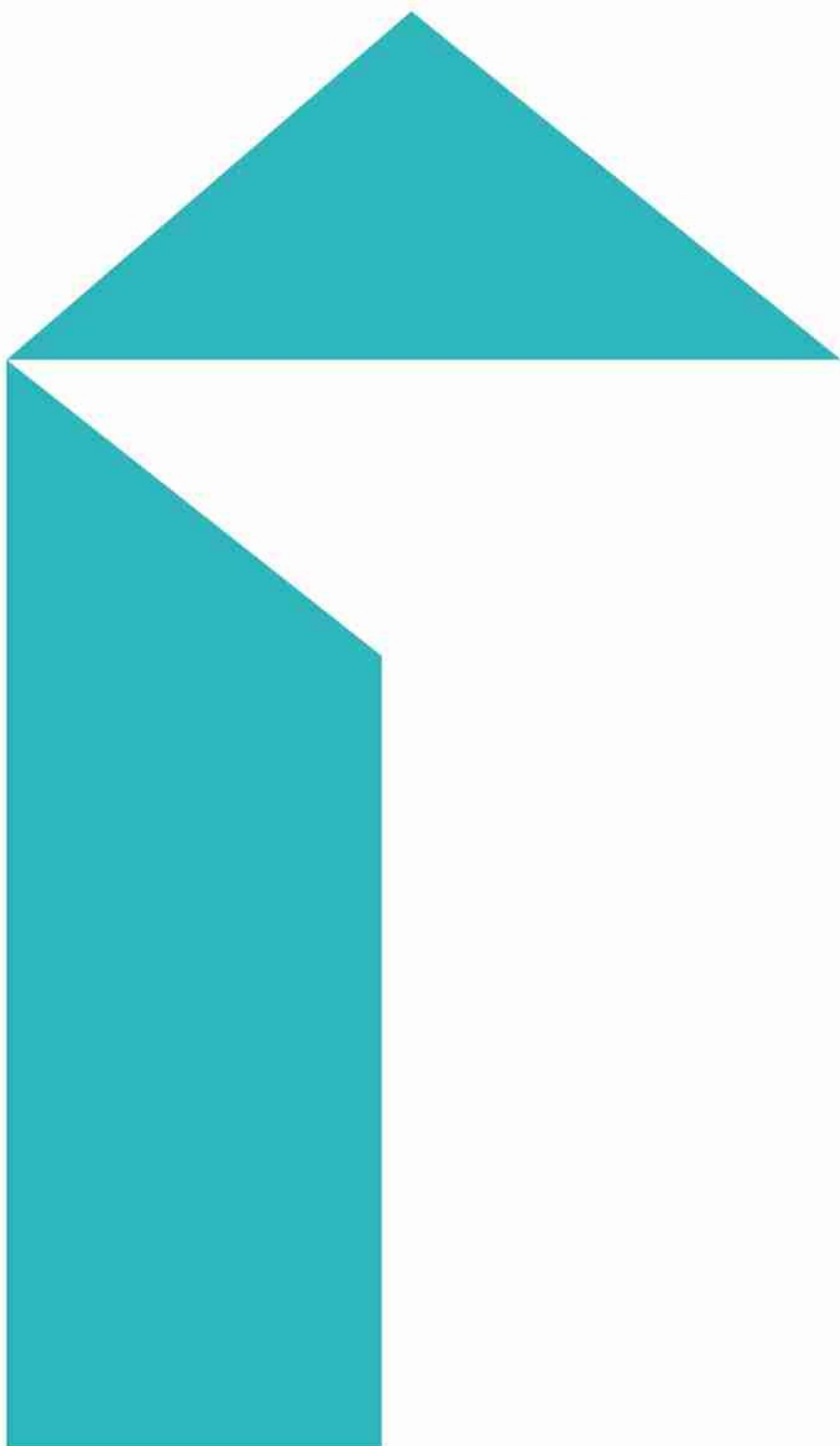
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B.6 Site 006 location plot – M3 J1



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3 Wellington Place
Leeds
LS1 4AP
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Manchester
M15 4RP

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