UK Roads Leadership Group

TRANSPORT TECHNOLOGY FORUM

Well Managed Highway Infrastructure: Management of Roadside Technology (MRT)





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Introduction

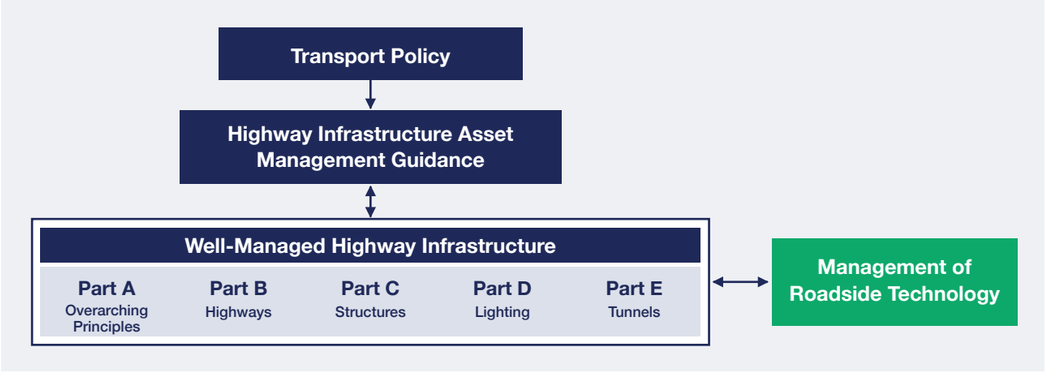
This document has been promoted by the UK Roads Leadership Group (UKRLG) and funded by the Department for Transport (DfT). It provides important guidance for local authorities that own and operate roadside technology on their networks.

Effective maintenance of these assets is essential. Following the advice and recommendations in this document will help authorities maintain their assets and reduce the risk of equipment having to be switched off or removed. In turn, well-maintained roadside technology can help reduce congestion and provide network users with the information they need to make informed decisions about their journeys.

The Management of Roadside Technology (MRT) document provides good-practice guidance for the effective management of roadside technology and associated electronic highway assets throughout their lifecycle. It should be read in conjunction with Part A: Overarching Principles of *Well-managed Highway Infrastructure: A Code of Practice*, which provides the overarching framework and principles for the management of highway infrastructure.

The UKRLG guidance hierarchy is illustrated in the figure below. The overarching principles set out in Part A of the Code apply equally to the management of roadside technology. Accordingly, MRT adopts an integrated, risk-based and evidence-led approach, recognising that effective asset management requires sound engineering judgement, appropriate governance, reliable asset information and proportionate decision-making that reflects local needs, risks, priorities, resources and affordability.

MRT supports highway authorities in establishing locally appropriate arrangements for the planning, design, specification, procurement, installation, commissioning, operation, inspection, maintenance, renewal and eventual decommissioning of roadside technology. These arrangements should take account of whole-life performance, safety, resilience, interoperability, cybersecurity, sustainability, climate resilience and technological change.



Foreword

In the United Kingdom, the increasing use of technology in the highways sector has enabled local authorities to manage their highway networks and traffic more effectively, helping to manage congestion, improve network performance and reduce carbon emissions.

The implementation and management of technology varies between highway authorities. With the rapid development of emerging technologies, including Connected Vehicles and Artificial Intelligence (AI), this document provides consistent guidance on the maintenance and management of traffic management and control systems and roadside Intelligent Transport Systems (ITS) technology.

The management of roadside technology continues to evolve as digital connectivity, automation, artificial intelligence and data-driven systems develop. Management of Roadside Technology (MRT) is intended to support this evolution while maintaining the fundamental principles of safety, resilience, accountability, cyber security, competence and effective asset management. As technologies and industry practices develop, the guidance will be reviewed and updated to remain relevant to the changing needs of highway authorities.

This document also supports and references the Manual for Smart Streets (MfSS) as a resource to help stakeholders make effective use of data and emerging technologies for streets and highways. MfSS helps local authorities identify and apply technology to address traffic and transport management challenges, supported by practical use cases and real-world case studies.

While the introduction of new technology is important, effective maintenance is equally essential to ensure that equipment continues to perform safely, reliably and effectively throughout its whole life cycle.

Each local authority is responsible for managing its own assets. However, there has historically been limited consistent guidance on how roadside technology should be managed and maintained, resulting in differing approaches and standards across the UK.

This document builds on the UK Roads Leadership Group (UKRLG) Code of Practice and draws upon industry expertise and established good practice in the management and maintenance of these assets.

Maintenance and asset management programmes should be developed in accordance with the practical advice contained within MRT, helping highway authorities manage their assets effectively and make best use of available funding.

The benefits of well-maintained and well-managed traffic signal infrastructure have been demonstrated through Department for Transport (DfT) funded initiatives, including Traffic Signal Maintenance Funding (2021/22) and the Traffic Signal Obsolescence and Green Light Fund (TSOG/GLF) (2023), which demonstrated the value of targeted investment in traffic signal maintenance and renewal.

This document is promoted by the UK Roads Leadership Group, with support from the Department for Transport, and provides important guidance for local authorities that own and operate roadside technology across their highway networks. Effective maintenance and management of these assets is essential to supporting safe, reliable and efficient highway networks and enabling road users to make informed decisions about their journeys.

Given the pace of technological development, MRT should be regarded as a living document, subject to periodic review and update to reflect emerging technologies, changing operational requirements and evolving good practice.

Gafoor Din HonFIHE
Service Manager for
Traffic Control & Information Systems
Warwickshire County Council

Executive Summary

MRT provides local authorities with guidance for developing effective, sustainable maintenance and operational policies for roadside traffic technology in a constantly changing environment. The principles of asset management are central to this approach and adopting the recommendations will help authorities deliver high-quality services.

While MRT is written specifically for the local authority sector, its principles may also be applicable to maintenance arrangements in other sectors.

An Implementation Plan is critical to the successful implementation of MRT's recommendations. Local authorities should develop an Implementation Plan covering short, medium and long-term scenarios in order to provide the public with a network of optimised equipment. Emphasis should shift, as far as possible, from a reactive to a proactive approach to maintenance planning, with programmes for proactive maintenance and asset refurbishment or renewal, all within the framework of an asset management plan.

MRT gives detailed guidance on the maintenance requirements of all types of electronic traffic equipment. It also advises on options for maintenance contracts and for procuring power and communication services, so that each authority can select those most appropriate to its requirements across the full range of services needed.

Maintenance also needs to cover the use of data from electronic equipment and the security of that data, including third-party equipment residing in roadside equipment for classified data collection and service delivery.

MRT addresses the whole life cycle of assets. Designers should consider maintenance requirements during the design process, with associated costs assessed before implementation. This will help authorities understand the true whole life cost of providing new assets.

MRT recognises that roadside technology will continue to evolve through increased connectivity, automation, artificial intelligence (AI) and data-driven systems. Authorities should adopt emerging technologies in a proportionate and evidence-based manner, ensuring appropriate human oversight, accountability and auditability, together with effective cyber security, data protection and competent decision-making. New technologies should support, rather than compromise, the safety, resilience and effective management of roadside technology assets.

The key principles in MRT are not mandatory. In line with the key asset management principle of focusing on user needs and expectations in the design and delivery of services, authorities should have reasonable discretion in how they adopt MRT guidance.

MRT assumes that available maintenance funding will provide authorities with some flexibility to assess needs and plan programmes and priorities accordingly. Where this is not the case, statutory obligations for network safety must take precedence.

> **Key Principles: These are made throughout the MRT in highlighted text and summarised in Appendix A.**

Objectives of the Management of Roadside Technology

The objectives of Management of Roadside Technology are to:

- Promote the adoption and application of asset management principles;
- Encourage the development and regular review of policies for managing roadside technology;
- Focus on the needs of all road users;
- Adopt good practice and new technology;
- Promote efficiency;
- Adopt innovative applications and the effective use of new technology.

Scope of the MRT

MRT provides guidance on planning and managing the maintenance of electronic traffic equipment and other roadside technology, in the context of good practice and performance improvement. It is not intended as a detailed technical reference for every aspect of roadside technology or to repeat technical guidance available elsewhere, such as the MfSS.

The UK Roads Leadership Group (UKRLG) provides guidance and codes of practice that can be accessed here: https://ukrlg.uk.net/

Technologies covered by MRT

MRT covers a broad range of roadside technology and electronic traffic equipment, with the principal asset types and associated standards and specifications summarised in Appendix E: Roadside Technology Assets and Relevant Standards and Specifications. The following technologies are addressed in greater detail within this document:

- Traffic signals – including junctions and shuttle working scenarios under traffic signal control;
- Crossing signals – including any non-motorised traffic controlled by signals, for example pedestrian, Toucan and equestrian crossings;
- Other signals – including cattle crossings, School Crossing Patrol flashing amber warning signs and wig-wags as commonly situated outside emergency service stations;
- Interactive and timing activated signs – including vehicle activated signs;
- Variable message signs – including dot matrix, Light Emitting Diode (LED) type and standard text prism signs, and signs for car park management systems;
- In Vehicle Message Signs;
- Digital Controller Interface Standard;
- Data Management and Security;
- Communication systems – 4G/5G WiFi Mesh systems;
- Connected Vehicles (TTF Interest Group);
- D-TRO (TTF Working Group);
- AQM - Low Emission Zone systems;
- EV Infrastructure (TTF Interest Group) - charge points and associated infrastructure;
- Smarter Parking;
- Road safety cameras – including red light, average speed and fixed-point speed cameras;
- Real Time Passenger Information Systems;
- Traffic monitoring equipment – including vehicle count sites, classified count sites, traffic flow data collection sites and Automatic Number Plate Recognition cameras;
- Rising bollards – including rising steps and barriers;
- CCTV cameras – including only fixed location cameras;
- Over-height vehicle detection systems – including detection control and integrated signs.

Equipment not covered by MRT

- Any mobile infrastructure – only permanent and fixed infrastructure is covered by MRT;
- Tunnel management systems – every tunnel system is unique; however, some of the elements used within a tunnel management system are covered by MRT;
- Infrastructure placed exclusively within the motorway and trunk road network: refer to guidance produced by National Highways and others. Where infrastructure is located where the trunk road network meets the local authority network, it is in the public interest for the two authorities to liaise with each other to provide the optimum service level;
- Tidal flow systems: these systems are bespoke and any authority considering deploying one should address maintenance requirements as part of the design, producing its own guidance document as appropriate. Parts of MRT may be relevant to certain technologies used within a tidal flow system;
- Road user charging systems: these systems are bespoke and any authority considering deploying one should address maintenance requirements as part of the design, producing its own guidance document as appropriate. Parts of MRT may be relevant to certain technologies used within a road user charging system;
- Railway and tramway interaction - interaction between the road network and tramway systems should be considered separately by the authority, considering the bespoke nature of the interaction and users of both systems.

Use of Management of Roadside Technology

Parts of the guidance and information in this document will inevitably become dated over time and some recommendations may need review in light of new experience and knowledge. MRT is intended to be an online resource, revised and enhanced regularly or as new technologies are adopted by authorities.

MRT is intended to complement existing and emerging technical guidance and Codes of Practice. The full suite of UKRLG Codes of Practice and Guidance can be accessed here: https://ukrlg.uk.net/

MRT is designed to integrate with the Manual for Smart Streets (MfSS), which helps local authorities identify and use technology to address traffic and transport management challenges. It identifies technologies that deliver efficient, safer mobility quickly and cost-effectively and provides use cases and real-world case studies.

Implementation of Management of Roadside Technology

Authorities should review their policies and practices at regular intervals, in line with MRT and the complementary guidance provided by MfSS and UKRLG. Where an authority decides not to implement a particular MRT recommendation, the variation should be managed as described below.

Authorities should first undertake a full review of current practice within their organisation. Once this is understood, they should identify any gaps where existing procedures do not reflect MRT recommendations or guidance and have not been varied through agreed local practice.

This gap analysis should identify areas that are either not covered by current practice or are not covered in sufficient detail. Authorities should then develop action plans to address the gaps identified.

Each Implementation Plan should address all items identified below:

- Any variations from the recommendations given in MRT should be clearly recorded within the Implementation Plan and in any appropriate policy or service standard documents, including reasons given for the variation;
- MRT does not specify a timescale or order for implementation. Authorities are responsible for determining an appropriate timeframe and sequence for introducing new procedures, taking account of wider priorities where relevant;
- The development of the Implementation Plan should be managed as a formal project, with agreed milestones, resources and budgets.


Photo: Warwickshire County Council

Key Principle 1: Authorities that adopt policies, procedures or standards that differ from those recommended in this document must clearly identify and document the variations, including the reasons for them, and obtain appropriate approval. Once established, procedures for managing maintenance requirements should be reviewed regularly to ensure they remain fit for purpose and comply with current regulations and guidance.

Key Principle 2: Authorities should undertake a comprehensive review of current practices and identify any differences from the key principles in Management of Roadside Technology. Any gaps should be addressed through a formal Implementation Plan, managed as a structured project with agreed milestones, resources and budgets.

Section 1
Introduction



1.1 The Traffic Management Context

The effective operation of the highway network is critical to economic prosperity and social inclusion. Moving people and goods easily around the network supports the effective operation of businesses, schools, hospitals and events, and underpins Active Travel and Mobility as a Service (MaaS).

Road networks are becoming increasingly congested, making a well-managed, well-maintained network - supported by information and ITS services for road users - more important than ever. Traffic congestion affects all road users, increasing journey times and costing the economy. It also has a significant environmental impact, contributing to increased emissions.

MfSS Use Case: https://mfss.ttf.uk.net/manual-for-smart-streets/use-cases/traffic-management/

1.1.1 Traffic Control and Monitoring

As traffic volumes increase, roadside technology and associated equipment play a vital role in keeping the network moving. Network management increasingly relies on transport data and integration with Connected Vehicles to measure network performance and deliver accurate, innovative services to road users, such as In-Vehicle Message Signs (IVMS) or Blue Light vehicle traffic signal priority.

Traffic control and monitoring infrastructure is an effective way of managing current and future traffic. In many cases it offers a more environmentally acceptable solution to reducing congestion than constructing network improvements such as carriageway widening. Its use is therefore increasing and set to continue as technology finds new, more effective ways of managing traffic.

1.1.2 The Importance of Maintenance

MRT provides guidance for establishing and managing an effective maintenance regime to ensure that all traffic control and monitoring infrastructure and roadside technology performs to the required standards.

Fully commissioned equipment can cease to work for many reasons, including poor design, poor installation, vandalism, other third-party damage, age, poor maintenance, malfunction or obsolescence. As with all technology, what is cutting-edge today will eventually become obsolete, particularly through component obsolescence. Equipment installed today typically has a whole life cycle of around twenty years, though some equipment needs replacing sooner because of obsolescence.

Failure of electronic traffic equipment can pose serious risks to network use. In a worst-case scenario, equipment failure may endanger the travelling public and expose the authority to litigation if the problem is not dealt with effectively.



Photo: Warwickshire County Council

Congestion caused by poor maintenance can also increase gradually over several years. Without appropriate monitoring, this may go unnoticed and be wrongly attributed to traffic growth rather than the underlying cause. Effective performance of electronic traffic equipment therefore requires a maintenance regime that includes both reactive and preventative activities.

1.1.3 Value for Money (VfM)

All parties involved in managing the network are expected to seek ways to improve the service to meet users' needs. New technologies should be introduced on the basis of demonstrated value for money (VfM), taking into account whole life costs - including capital, operational, maintenance and energy costs - alongside potential service and performance improvements. Many authorities use key performance indicators (KPIs) to measure service delivery and provide a baseline against which improvements can be measured, within the context of a wider highway service performance management framework.

> **Key Principle 3: All parties involved in delivering the service should seek ways to improve it to meet customers' needs. New equipment, processes and strategies should have identifiable, tangible benefits. Cost should not be the only consideration, as other qualitative factors also matter.**

1.2 Asset Management Context and Principles

MfSS Use Case: https://mfss.ttf.uk.net/manual-for-smart-streets/use-cases/asset-management/

Smarter asset management helps local authorities build on their existing capabilities, make use of new technologies, access new and connected asset data, improve systems and data integration, and co-ordinate applications to optimise maintenance management - supporting essential infrastructure for communities, commerce and wider society.

MRT is based on the principles of asset management and therefore seeks to promote value for money and continuous improvement within the core objectives of highway maintenance, to deliver a safe, serviceable and sustainable network, taking into consideration user needs. These objectives are described in "Well Managed Highway Infrastructure: Code of Practice" and the MRT follows the same core objectives.

It is widely recognised that an asset management approach helps authorities use resources efficiently in delivering the highway service, while supporting a framework for documenting evidence of decisions made and improving transparency and accountability.

1.2.1 Data

The wider use of transport data is essential, not only for asset management purposes but also for achieving transport policy objectives that deliver tangible user benefits and the delivery of innovative transport services, particularly with the increased use of C-ITS and connected vehicles.

The Digital Controller Interface Specification (DCIS) is a national standard for traffic signals in the UK, aiming to provide a unique identifier for each signalised junction and standardise how traffic signal data is described and shared. It focuses on digitising information about signalised locations, including their layout, configuration and operation, using JavaScript Object Notation (JSON) schemas. This allows for better management, modelling and data sharing related to traffic signals.

It also introduces a national numbering scheme for traffic signals, known as the Simmonite Number.

This will provide an additional unique national identifier for traffic signals, alongside the locally derived Site Controller Number (SCN), which highway authorities will continue to use to manage their signals.

The Simmonite Number is being introduced as part of the ongoing development and adoption of DCIS and is intended to become a long-term national identifier as adoption increases.

DCIS provides a consistent way to identify and describe traffic signal controllers, improving data sharing and management across systems and authorities.



Photo: Clearview Intelligence

Key aspects of DCIS include:

- **Unique identification:** A Simmonite Number is assigned to each traffic signal controller, building on existing local identifiers;
- **JSON Schemas:** These describe the features of a signalised junction, including staging, phasing, turning movements and timings;
- **Digital processes:** These support a move away from traditional paper-based or ad hoc approaches to managing signal controller data towards standardised digital processes.

The benefits of using DCIS include:

- **Improved data management:** Standardised identification and data formats improve the management and sharing of traffic signal controller information;
- **Reduced development costs:** A consistent approach to describing traffic signals enables more efficient system development and integration;
- **Enhanced operability:** Standardised interfaces improve communication and data exchange between systems and stakeholders, including local authorities and connected vehicle applications.

DCIS is an important step towards creating a connected and efficient digital infrastructure for traffic management. Authorities are recommended to adopt DCIS as soon as practicable.

As authorities move towards an increasingly connected digital future, cyber security and data security must be appropriately considered and managed. The Design Manual for Roads and Bridges (DMRB) TM 101 Traffic Signalling Systems (Maintenance and Operation) states that security threats to traffic signalling systems must be mitigated in accordance with the Network and Information Systems Regulations (UK SI 2018/506). Where security threats are identified, they must be assessed, documented, mitigated and appropriately managed.

> **Key Principle 4: Detailed asset and data management systems must be put in place and maintained, including data security measures.**

Accurate, reliable data on roadside technology equipment is essential for making appropriate investment decisions on support and maintenance requirements. Inventory data should include asset type, relevant attributes and location, and, where appropriate, current condition, date of last inspection and last maintenance action. This data should be stored in a format easily accessible to local authorities and their contractors.

Consideration should also be given to the information that is needed to meet the requirements of Whole of Government Accounts in reporting asset value for relevant equipment.

Most authorities use Information Technology (IT) systems for the management of their data. Effective use of such systems may support authorities in defending third party claims by providing reliable information that can be used as a legal defence.

1.2.2 Serviceability

Determining appropriate service levels for each asset type is fundamental to asset management. Authorities should base these levels on the needs of network users and on maintaining reliability, availability, integrity and condition. Service levels should be set out in the local authority's policy for each asset type.

1.2.3 Life Cycle Planning

To deliver value over the whole life cycle of an asset, authorities should base investment decisions on whole life cycle planning wherever practicable, taking account of installation, operation, maintenance, asset renewal, energy consumption and decommissioning costs. Whole life cycle costs should be calculated during the design process, so that maintenance can be properly considered before installation.

Whole life cycle planning helps local authorities optimise investment over an asset's life by identifying in advance the optimal time for refurbishment. Planning refurbishments around the asset's anticipated life helps minimise the faults it develops over time. Maintenance interventions should be planned for when fault rates are expected to rise as components deteriorate.

A whole life cycle approach allows local authorities to prepare long-term maintenance programmes for their assets and to prioritise preventative maintenance to meet service levels and other network requirements. Proactive planning also allows these activities to be combined by asset type or location, minimising the impact of maintenance on road users.

1.2.4 Risk and Reliability

Reliability of roadside technology is crucial to both the local authority and network users. The authority needs to manage reliability risk so that faults or operational issues can be treated as genuine and fixed or resolved within a reasonable timeframe. Local authorities may wish to consider preventative, risk-based maintenance strategies that take account of asset criticality and condition.

The importance of risk management as a component of asset management is now fundamental both at the strategic level to inform decisions on investment and priority and at the operational level to improve regimes of defect inspection and repair.

An increasing number of users are pursuing claims against authorities for injury or damage where they consider the authority has failed to maintain an asset to the required standard. This document therefore stresses the need for authorities to establish and publish clear strategies and policies and to maintain consistent, detailed regimes of inspection, repair, recording and monitoring.

Legislation on corporate manslaughter has been used in cases involving various aspects of highways maintenance and is an understandable cause for concern. The best approach is to comply with this document and obtain clear Member approval for policies and programmes, particularly for any deviations from MRT.

Further guidance for handling risk and liability claims can be found in the Institute of Highway Engineers (IHE) publication "Well Managed Highway Liability Risk".

1.2.5 Roadside Technology

Technological change is, and will remain, integral to roadside technology and electronic traffic equipment. Accelerating innovation is enabling local authorities to address issues that could not have been solved a few years ago.

Authorities should, as far as possible, future-proof their assets and systems when establishing effective maintenance and operational regimes. Connected vehicles and other emerging technologies will further enhance connectivity and services for road users, as part of the developing DfT strategy to deliver connected services based on real-life use cases.

Key Principle 5: Local authorities should future-proof roadside technology, systems and processes as far as practicable. This means selecting current, supported and non-obsolete technologies that can be readily maintained, updated and upgraded across both hardware and software. Procurement should also consider long-term support, compatibility, upgrade paths and anticipated obsolescence, helping to maximise asset life, whole-life value and the ability to adapt to future operational and technological requirements.

1.3 Towards Sustainable Maintenance

A sustainable approach is a core objective of highway maintenance. Each local authority should base its maintenance regime on sustainable, affordable principles. Good practice in managing roadside technology and traffic equipment helps reduce journey times, congestion and emissions, including carbon dioxide.



Photo: Swarco

1.3.1 Recycling and Re-use

Where possible, authorities should support the recycling and re-use of equipment within their maintenance regime. Re-using equipment helps reduce landfill and is also likely to reduce the authority's replacement costs. Where re-use is not possible, the authority should ensure equipment is recycled wherever possible.

Key Principle 6: Where possible, authorities should support the use of recycling and re-use of equipment within their maintenance regime.

1.3.2 Energy

The cost of energy and the drive to reduce carbon emissions have led to several innovative approaches to powering roadside technology and equipment. The need to reduce energy consumption has driven many recent technology developments and Extra Low Voltage (ELV) equipment is now the norm. Renewable energy, such as solar power, should also be considered during the design process wherever possible, providing both financial and environmental benefits.

Key Principle 7: Local authorities should make low-energy equipment the norm for new installations and consider whole-life energy consumption alongside installation, operation and maintenance costs. Where practicable, older high-energy equipment should be upgraded or retrofitted with lower-energy technology. Where legacy or obsolete equipment cannot be economically or technically retrofitted, authorities should consider planned modernisation or replacement, taking account of asset condition, obsolescence, available funding and whole-life value.

1.3.3 Qualified Personnel (including training policy)

The Implementation Plan should address the resources and skills needed for delivery. At least one member of the maintenance team - preferably the Team Leader - should fully understand the Implementation Plan and its implications for the team's practices.

All staff managing roadside technology and associated equipment should have appropriate experience, skills, training and equipment to perform their duties. Monitoring of these areas should be co-ordinated to ensure appropriate competence and delivery, with ongoing training to support changes in technology, materials and procedures. All personnel should understand personal and task-related risks and be aware of the available range of actions and options.

If an authority does not currently have the required experience, there are several options that should be considered:

- Recruitment of experienced resources;
- Training of existing staff through formal courses or on the job training;
- Training of existing resources through partnering approaches with other authorities or partner organisations;
- Outsourcing.

Adequate training and resources are vital to the maintenance and use of roadside technology. Authorities should make use of all training resources available especially from resources such as the IHE, CIHT and ITS UK etc.

Key Principle 8: Authorities should ensure that suitably trained staff are in place to undertake the management of maintenance of roadside technology and its associated equipment.

Maintaining authorities should ensure that all personnel involved in designing, installing, operating, inspecting and maintaining traffic control and information systems are competent to carry out their duties safely and effectively. Competence should be demonstrated through appropriate qualifications, training, experience and continuing professional development.

The National Highways Sector Schemes (NHSS) provides recognised certification frameworks for highway contractors, aligned with ISO 9001 Quality Management Systems.

The schemes promote consistent standards of competence, quality and safety across highway activities, including maintenance, electrical works and temporary traffic management.

Where NHSS certification is not a mandatory requirement, authorities should adopt a proportionate approach to procurement, recognising that requiring formal certification may create barriers for suitably competent small and medium-sized enterprises (SMEs). Appropriate equivalent evidence of competence, quality management, technical capability and relevant experience should therefore be considered where appropriate.



Photo: Rennicks

1.3.4 Management of Data and Other Information

Assets that exist outside physical infrastructure include drawings, databases, inventories, inspection records, test certificates and designs holding valuable information about installed equipment and its intended use. When setting up a management system, links to this data should be considered for ease of operation and all authorities should develop and operate detailed management systems for their data and other information.

These systems help manage assets effectively in line with each local authority's defined maintenance strategy and support appropriate risk assessment. They should include fault and repair histories, plus the results of inspections and electrical and structural testing, to allow condition monitoring and inform future replacement programmes. This information establishes maintenance requirements and supports capital and revenue bids. A properly maintained data management system holds information that can be used effectively and efficiently across all aspects of the service.

1.3.5 Performance Measures and Targets

To understand whether MRT is effective, local authorities must set several performance measures and targets. These should establish clear, concise and challenging baselines, providing a framework for delivering year-on-year improvements and demonstrating to stakeholders that this makes a real difference to the service they receive.

Key Principle 9: Performance indicators should be used to measure authority and contractor effectiveness in delivering the service and to provide a baseline from which improvements can be measured.

1.3.6 Financial Plans

It is recognised that both capital and revenue funding is not always available, so Management Plans should contain a staged approach as described below:

- Stage 1: Short term measures to provide an operational setup that can manage day to day activities.

As part of the Management Plan, the local authority should as a minimum provide funding for what should be one-off costs of establishing or updating their systems in accordance with the guidance provided in MRT.

Implementation may include a digital library of design records for each asset and rectifying any issues in the set-up of remote monitoring and fault management systems. New technology and systems can make this easier and help justify capex and opex spend on an evidence-based footing. Short-term funding should also cover rectification of any urgent legal and safety-critical issues discovered during implementation and should preferably be based on a worst-case scenario.

- Stage 2: Medium term measures to maintain on an ongoing basis.

In Stage 2, once issues raised under Stage 1 have been rectified, authorities should ensure funding is secured to adequately maintain and replace current assets on an ongoing basis over each asset's whole life cycle. Stage 2 may overlap with Stage 1, depending on funding availability.

- Stage 3: Long term measures to cover a whole life cycle approach.

In Stage 3, authorities should develop an action plan to ensure that adequate funding is available for life cycle maintenance of current and future installations.

The authority should define its own life cycle targets based on good practice, considering each asset's whole life cycle up to the point where maintenance becomes too problematic and replacement is needed. The authority should aim to define asset replacement after a set number of years and ensure sufficient funding is held in a separate refurbishment budget to meet this target.

Key Principle 10: Authorities should provide financial plans for maintenance and operation of roadside technology that detail their priorities as well as clear direction on how the operations will be managed in the short, medium and long term.



Photo: Warwickshire County Council

1.3.7 Prioritisation of Needs

As part of its Implementation Plan, the authority should clearly state its priorities and how it intends to address them in the short, medium and long term. It is, however, the responsibility of each authority to set its own network priorities, based on its own needs and those of its road users.

Authorities should not proceed with a plan that has no reasonable expectation of providing for the long-term sustainability of their systems with reasonable whole life expectancy. Should sufficient funding not be available, those accountable should be informed of the need to reduce their expectations to the funding levels available.

1.3.8 Systems to Process and Manage Faults

The authority must ensure that an adequate management system exists to process and manage faults.

A data management system must be used, and authorities should ensure that each asset is correctly configured within the system database and can communicate effectively with the instation. Failure to maintain effective system operation may result in faults remaining unreported and unrepaired, increasing risk to both the public and the authority, as well as leading to inaccurate KPIs and poor asset performance across the network.

Key Principle 11: Authorities should ensure that adequate data management systems are in place to process and manage faults.

1.3.9 Appropriate systems for the asset

Larger local authorities with many assets will need a different approach from very small authorities with few assets to maintain. However, all authorities, regardless of size, should establish and implement a process for maintaining their assets and systems that is fit for purpose.

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Section 2
Policy and Provision of Service



2.1 Legal Powers, Duties and Applicable Guidance

Local authorities have legal obligations with which they must comply and which may occasionally be the subject of claims or legal action by those seeking to establish non-compliance. In such cases, the contents of MRT may be a relevant consideration. Where a local authority elects, in light of local circumstances, to adopt policies, procedures or standards different from those in MRT or other advice, it is essential that the differences are identified, the reasoning recorded and the alternative approach approved as appropriate by the authority.

Legal obligations relating to serviceability include duties for network management and sustainability requirements under environmental legislation. Where applicable, MRT reflects these statutory requirements.

Highway authorities and traffic authorities are subject to a range of statutory duties and powers governing the provision, operation, and maintenance of traffic control systems. In particular, under Section 122 of the Road Traffic Regulation Act 1984 (as amended), authorities are required to secure the expeditious, convenient and safe movement of vehicular and other traffic, including pedestrians, while having regard to a range of factors including road safety access, and environmental considerations. The effective management, operation and maintenance of traffic control systems form an essential component in discharging this duty.

The Traffic Management Act (TMA) (England and Wales, 2004)

The Traffic Management Act was introduced in England and Wales in 2004 to tackle congestion and disruption on the highway network. The Act places a duty on local traffic authorities to ensure the expeditious movement of traffic on their road network and those networks of surrounding authorities. The Act gives authorities additional tools to better manage parking policies, traffic enforcement and the co-ordination of street works. The Act states that local traffic authorities shall make appropriate arrangements for performing the network management duty, including the appointment of a Traffic Manager. (England and Wales, 2004).

https://www.legislation.gov.uk/ukpga/2004/18/contents

In Scotland, the Transport (Scotland) Act 2005 establishes the statutory framework for the Scottish Road Works Commissioner, whose functions include monitoring compliance with road works legislation. This framework was subsequently strengthened by Part 9 of the Transport (Scotland) Act 2019, which introduced further provisions relating to the Commissioner's functions, inspection and enforcement of road works requirements.

In England and Wales, Part 2 of the Traffic Management Act 2004 places a Network Management Duty on local traffic authorities to secure, so far as reasonably practicable, the expeditious movement of traffic on their road networks and to facilitate such movement on the networks of other authorities. Traffic control systems, including traffic signals and variable message signs, are important tools in supporting the effective management and operation of the highway network.

All traffic control systems deployed on the public highway - including traffic signals, pedestrian crossings, vehicle-activated signs (VAS) and variable message signs (VMS) - shall comply with applicable primary legislation, secondary legislation and relevant national standards. These include, but are not limited to:

- Road Traffic Regulation Act 1984;
- Traffic Management Act 2004;
- Equality Act 2010;
- Traffic Signs Regulations and General Directions 2016 (TSRGD 2016).

In accordance with Section 64 of the Road Traffic Regulation Act 1984, traffic signals, road markings and associated equipment are legally defined as "traffic signs" and must therefore be of a type prescribed or authorised. Section 65 provides highway authorities with the power to place and maintain such traffic signs on or near a road.

The provision of pedestrian crossings is governed by Section 23 of the Road Traffic Regulation Act 1984 (as amended), which requires traffic authorities to consult with the chief officer of police and to provide public notice before establishing, altering or removing crossings. The requirement to notify the Secretary of State was removed by subsequent legislative amendments, including the Deregulation Act 2015.

Traffic control equipment must comply with TSRGD 2016 including the requirements of relevant BS EN Standards referenced in Schedule 14. TOPAS (Traffic Open Products and Specifications) currently maintains technical procurement specifications and a register of equipment assessed as meeting those requirements. Where applicable, authorities should specify equipment that meets recognised and current technical standards, with appropriate evidence of compliance, to support safety, interoperability and fitness for purpose.

The future arrangements for TOPAS, including the ongoing provision of its standards are being developed. Authorities should therefore have regard to the current arrangements and recognised standards in force at the time of procurement, including any successor or alternative framework to TOPAS where applicable.

Authorities are responsible for ensuring that traffic control installations are designed, operated and maintained in a manner that enables them to meet their duties under the Equality Act 2010, including the Public Sector Equality Duty, and to provide infrastructure that is accessible and inclusive for all users.

2.2 Standards and Good Practice

The **Design Manual for Roads and Bridges (DMRB)** provides nationally recognised standards and guidance for the management, inspection, operation and maintenance of traffic control systems:

- **TS 101 – Traffic Signalling Systems (Inspection and Assessment)** sets out requirements for inspection, assessment and asset management activities, including asset records, fault monitoring and risk-based maintenance practices;
- **TM 101 – Traffic Signalling Systems (Maintenance and Operation)** establishes a whole-life framework for the maintenance and operation of traffic control systems, expanding on inspection, performance monitoring and operational requirements.

While these documents are mandatory for the strategic road network, they are widely adopted by local highway authorities as recognised good practice, supporting effective asset management, road safety assurance and risk-based decision-making. Maintaining accurate asset records and monitoring system performance are essential to effective risk management and help authorities meet their statutory duties.

As part of maintaining traffic control systems, the maintaining authority has a duty to take all reasonably practicable measures to ensure the safety of maintenance personnel, contractors and members of the public. This responsibility is underpinned by statutory health and safety legislation and supported by national standards and guidance.

DMRB TM 101 – Traffic Signalling Systems (Maintenance and Operation) provides a comprehensive framework for maintaining authorities and summarises key statutory requirements relating to both road safety and electrical safety. These requirements should be embedded within maintenance specifications, procedures and working practices. Robust management arrangements should ensure that all personnel are appropriately trained, competent and equipped to undertake their duties safely.

Relevant legislation and guidance includes:

- Health and Safety at Work etc. Act 1974
- Management of Health and Safety at Work Regulations 1999 (as amended)
- Construction (Design and Management) Regulations 2015
- Electricity at Work Regulations 1989
- BS 7671 – Requirements for Electrical Installations (IET Wiring Regulations), current edition
- Traffic Signs Manual Chapters 6, 7 and 8 (current editions)



Photo: Warwickshire County Council

All electrical works shall comply with the Electricity at Work Regulations 1989 (SI 1989/635). Compliance should be demonstrated through application of BS 7671, as amended, which provides the nationally recognised standard for electrical installation safety.

In Northern Ireland, equivalent legislation applies, including the Management of Health and Safety at Work Regulations (Northern Ireland) 2000 and the Construction (Design and Management) Regulations (Northern Ireland) 2016.

The New Roads and Street Works Act 1991 (NRSWA) places statutory duties on highway and street authorities to coordinate and regulate works undertaken within the highway. Maintaining authorities should work closely with their designated NRSWA coordinator and utility undertakers to ensure compliance with statutory requirements, minimise disruption to road users and support the safe and efficient operation of the highway network.

2.3 Management of Maintenance

All electronic traffic control and information systems require effective inspection, operation and maintenance throughout their lifecycle to ensure the continued safety of road users, operational reliability, statutory compliance and the protection of asset value. A well-managed maintenance regime contributes to network efficiency, minimises service disruptions and supports the achievement of broader highway authority objectives.

Maintenance activities are typically categorised as:

- **Reactive Maintenance** – responding to defects, faults, failures or damage through repair, replacement or other corrective actions to restore the asset to its intended operational condition;
- **Proactive Maintenance** – planned and preventative activities, including routine inspections, testing, servicing and component replacement, undertaken to reduce the likelihood of failures and maintain system performance throughout the asset lifecycle.

Maintaining authorities should adopt a structured service management approach that clearly defines organisational responsibilities, contractual arrangements, response priorities, service levels and performance measures. Maintenance strategies should be aligned with the authority's asset management policies, risk management framework and network management duties to ensure that resources are targeted effectively and that safety-critical assets remain fit for purpose.

Maintenance programmes should be supported by accurate asset inventories, fault management systems, performance monitoring and documented maintenance procedures, enabling authorities to make informed, risk-based decisions regarding inspection frequencies, renewal priorities and investment planning.

2.3.1 Management and Operational Systems

Effective management of traffic control and information system assets requires the use of integrated management and operational systems to support asset stewardship, maintenance delivery, performance monitoring and financial control throughout the asset lifecycle. Such systems enable maintaining authorities to make informed, risk-based decisions, improve operational efficiency and demonstrate compliance with statutory and organisational requirements.

Management systems should, as a minimum, provide functionality for:

- **Comprehensive asset inventories** and equipment records;
- **Maintenance planning, scheduling and work instruction management;**
- **Fault monitoring, incident management and performance reporting;**
- **Energy consumption monitoring, carbon reporting and financial controls;**
- **Integrated geographic information and digital mapping,** including highway power supplies, underground cable networks, feeder pillars, communications infrastructure and equipment locations;
- **Inspection, testing and maintenance record management;**
- **Lifecycle planning, asset condition monitoring and renewal forecasting.**

Where practicable, systems should provide a single source of asset information and support the storage and management of associated documentation, including design drawings, commissioning records, operation and maintenance manuals, risk assessments, electrical certification, inspection reports, and statutory records.

Maintaining authorities should seek to adopt digital asset management practices that facilitate data sharing, interoperability and integration between operational, maintenance and asset management functions.

DCIS is strongly recommended. DCIS provides a standardised, digital framework for describing, exchanging and managing traffic signal controller data, supporting greater consistency across authorities and suppliers. Key features include:

- **Unique controller identification,** including the use of a nationally recognised controller reference (e.g. Simmonite Number);
- **Standardised data structures and schemas,** enabling consistent representation of staging, phasing, signal timings, detector configurations, and junction characteristics;
- **Digital workflows and data exchange processes,** reducing reliance on paper-based records and proprietary data formats.

The adoption of DCIS supports improved data quality, enhanced interoperability between systems, more efficient asset management processes and greater readiness for future integration with connected, cooperative and intelligent transport systems. It also provides a foundation for improved analytics, performance monitoring and the digital management of traffic signal assets throughout their operational lifecycle.

2.3.2 Fault Management Systems

Maintaining authorities should implement an effective Fault Management System (FMS) to support the timely identification, prioritisation, allocation and resolution of faults affecting traffic control and information systems. An effective FMS is a key component of service delivery and contributes significantly to network resilience, asset performance, customer service and road safety.

Where appropriate, the FMS **may support automated transfer of selected fault notifications** from Remote Monitoring Systems (RMS), Urban Traffic Control (UTC) systems and other fault detection or network management platforms to the authority's maintenance provider. **Authorities should determine which fault types are automatically reported based on operational requirements, risk, priority and local maintenance arrangements.**

The system should provide sufficient information to enable maintenance personnel to diagnose and rectify faults efficiently, including asset identification, location details, fault descriptions, severity classifications and any relevant operational data. Where practicable, the FMS should also support real-time status updates, fault tracking, performance monitoring, audit trails and reporting of maintenance activities.

Maintaining authorities should seek to integrate fault management processes across their wider traffic management and asset management systems to maximise operational effectiveness, improve data quality and support informed decision-making. Integrated systems can provide enhanced situational awareness, facilitate proactive network management and enable the identification of recurring defects, performance trends and asset renewal priorities.

> Key Principle 12: **Maintaining authorities should, where appropriate, enable the automated transfer of selected fault data from UTC, RMS and other network management platforms into an appropriate FMS. Authorities should determine which faults are automatically reported based on risk, operational requirements and local maintenance arrangements. Fault notifications should contain sufficient information to support effective diagnosis and repair. Data integration between traffic management, maintenance and asset management systems should also be encouraged to improve operational efficiency and support evidence-based asset management.**

2.4 Health and Safety

Local Authorities and contractors shall comply with all relevant health and safety legislation and recognised industry good practice. Personnel involved in the operation and maintenance of traffic control and information systems must be suitably trained, competent and equipped to undertake their duties safely.

The risks associated with working on the highway, electrical equipment and live traffic control systems shall be managed through appropriate risk assessments, safe systems of work and method statements. These controls should be regularly reviewed and consistently applied to protect both operatives and the public.

Maintaining authorities should promote a positive safety culture through effective training, supervision, monitoring and continuous improvement, ensuring that risks are reduced to as low as reasonably practicable (ALARP).

2.5 Environmental Awareness

Maintaining authorities shall comply with all relevant environmental legislation and consider environmental impacts when planning, operating and maintaining traffic control and information systems. Particular consideration should be given to measures that support improved air quality, reduced energy consumption and the delivery of initiatives such as Air Quality Management Areas (AQMAs) and Low Emission Zones (LEZs).

Local Authorities should ensure that personnel are aware of environmental responsibilities relevant to their role and should consider providing additional environmental training where appropriate. This will help support informed decision-making and promote the sustainable delivery of services.

2.6 Design and Installation for Maintenance

2.6.1 Design Overview

The design of traffic control and information systems shall consider whole-life maintenance, operational and asset management requirements from the outset. Design solutions should seek to minimise future maintenance interventions, reduce risks to operatives and road users and limit disruption to the highway network.

Maintenance liabilities should be designed out wherever reasonably practicable. Where residual maintenance risks remain, these shall be identified during the design process and appropriately managed through suitable design measures, documentation, and maintenance procedures.

Designs should promote safe access, efficient maintenance, asset reliability and long-term operational performance throughout the asset lifecycle.

2.6.2 Materials and Components

Materials and components shall be selected to ensure that traffic control assets meet operational, safety, and performance requirements throughout their service life. Designers should adopt a whole-life cost approach, considering durability, reliability, maintainability, availability of replacement parts and compatibility with existing systems.

Designs should promote standardisation and the use of proven products to reduce maintenance costs, operational risks and asset downtime. Environmental considerations, including waste reduction, reuse, recyclability and energy efficiency, should also be taken into account when selecting materials and equipment.

2.6.3 Installation

Traffic control systems shall be designed and installed to minimise risks to operatives and road users. Design solutions should reduce the need for working in the carriageway, at height or in other hazardous environments, while supporting safe and efficient maintenance.

Where practicable, designers should incorporate resilient and maintainable solutions, such as modular components and passive-safe or retention systems, to facilitate rapid repair or replacement following damage. Compatibility between equipment, including emerging low-voltage and energy-efficient technologies, shall be verified before installation.

2.6.4 Maintenance and Lifecycle Optimisation

Traffic control assets should be actively managed throughout their lifecycle to maintain safety, reliability and performance. Authorities should periodically review assets and, where appropriate, adopt newer technologies that provide demonstrable whole-life benefits.

Examples include considering alternative detection technologies, such as above-ground detection, where these are suitable for the required application and control strategy. The appropriate solution should take account of operational requirements, including more complex applications such as SCOOT, MOVA and speed assessment. As detection technologies continue to develop, authorities should consider emerging solutions where they can demonstrate appropriate performance, reliability and whole-life benefits. LED signal technology is another example of improving energy efficiency, reliability and asset life.

Such improvements support continuous improvement, enhance asset performance and contribute to the achievement of asset management and network management objectives.

2.6.5 Design for Maintainability

Designers shall ensure that inspection, maintenance, renewal and operational requirements are fully considered and integrated throughout the design process in accordance with the CDM 2015 and recognised whole-life asset management principles. Designers have a duty to eliminate foreseeable risks, so far as is reasonably practicable and to reduce and control residual risks associated with the installation, operation, maintenance and eventual decommissioning of the asset.

Early engagement with the highway authority and maintenance provider should be undertaken to identify maintenance constraints, operational requirements, access arrangements and lifecycle risks. This collaborative approach helps ensure that assets can be safely and efficiently maintained throughout their service life.

Design solutions shall facilitate safe, practical and cost-effective access for inspection and maintenance activities, minimising the need for temporary traffic management, lane closures, working at height, confined space entry or other high-risk working practices. Consideration should be given to equipment location, maintenance access, safe working areas, visibility, clearance requirements and the avoidance of physical obstructions that could adversely affect maintenance operations.

Designs should also seek to minimise whole-life costs and operational disruption by selecting durable materials, standardised equipment, accessible layouts, and resilient infrastructure that supports efficient maintenance and asset renewal.

2.6.6 Design CDM Requirements

The **Construction, Design and Management Regulations 2015 (CDM 2015)** establish the framework for managing health, safety and welfare throughout the lifecycle of construction projects, including the design, installation, operation and maintenance of traffic control systems.

Clients, designers and contractors have a duty to identify, eliminate or reduce foreseeable risks so far as is reasonably practicable. Designers should seek to design out maintenance and operational risks wherever possible and clearly communicate any residual risks to those responsible for construction, operation and maintenance.

All parties involved in the delivery and management of traffic control assets shall comply with their duties under CDM 2015 and ensure effective competence, cooperation, coordination and information sharing throughout the asset lifecycle.

Further guidance:

- **CDM 2015 Legislation** – https://www.legislation.gov.uk/uksi/2015/51/contents
- **Health and Safety Executive (HSE) Guidance** – https://www.hse.gov.uk/construction/cdm/2015/index.htm


Photo: Warwickshire County Council

2.6.7 Risk Assessment

A risk assessment should be undertaken for all new traffic control assets and consider the design, installation, operation, maintenance and eventual decommissioning of the asset. Designers should seek to eliminate risks wherever reasonably practicable and minimise any residual risks through appropriate design measures.

Significant residual risks that cannot be designed out shall be clearly documented and communicated through the design and asset records, particularly where they may affect future operation or maintenance activities.

Risk assessments should be retained within the asset documentation and reviewed periodically to reflect changes in site conditions, operating environments, or maintenance practices. Any material changes identified during the asset lifecycle should be recorded and the risk assessment updated accordingly.

In addition to site-specific risks, maintaining authorities should assess operational risks associated with inspection, maintenance, and renewal activities, ensuring appropriate mitigation measures are in place to support the safe and effective management of the asset.

2.6.8 Health and Safety File

A Health and Safety File shall be prepared and maintained in accordance with the Construction CDM 2015. It should contain information needed to safely operate, maintain, modify and decommission the asset throughout its lifecycle.

Designers shall seek to eliminate foreseeable risks through design and reduce any residual risks so far as is reasonably practicable. Significant residual risks shall be clearly recorded within the Health and Safety File and associated asset records.

The file should be retained in a durable digital format, made available to those responsible for operation and maintenance, and reviewed periodically to ensure it remains current. Risk information should be updated where site conditions, asset configuration or maintenance requirements change.

All parties undertaking works shall review relevant health and safety information and complete appropriate task-specific risk assessments before commencing work. Authorities should also consider risks associated with maintenance strategies and ensure suitable mitigation measures are in place.

2.7 Installation, Commissioning and Handover

2.7.1 Quality of Installation

Authorities shall ensure that contractors are competent and capable of delivering works to the required standards. Procurement shall comply with the **Procurement Act 2023** and associated regulations, applying the **Most Advantageous Tender (MAT)** approach to assess quality, competence, whole-life value and price.

Installation quality has a direct impact on asset safety, reliability, performance and future maintenance costs. Authorities should therefore define clear quality standards, inspection requirements and performance expectations within contract documentation.

2.7.2 Site Supervision

Appropriate site supervision shall be provided to ensure installations comply with approved designs, relevant standards and industry good practice. Effective supervision supports quality assurance, enables the early identification of defects and reduces future maintenance costs and operational risks.

Where in-house resources are unavailable, supervision may be undertaken by suitably qualified and competent third parties, provided appropriate independence and technical capability can be demonstrated.

2.7.3 As-built Records

Authorities shall ensure that comprehensive and accurate as-built records are produced, maintained and retained for all traffic control assets. Records should include the location, specification, configuration and details of all installed equipment, including underground apparatus and associated infrastructure. Information shall be maintained in a digital format and incorporated within the authority's asset management system and, where applicable, DCIS datasets.

Accurate asset records are essential to support safe operation and maintenance, minimise the risk of damage to existing infrastructure, facilitate future works and promote efficient lifecycle asset management.

2.7.4 Commissioning and Acceptance

Authorities should implement proportionate, risk-based Factory Acceptance Testing (FAT) and Site Acceptance Testing (SAT) arrangements for new installations, upgrades and renewals. Testing and acceptance requirements should reflect the nature, complexity and safety significance of the works, with defined acceptance criteria and verification against design specifications, manufacturer requirements and applicable standards.

For routine maintenance, like-for-like replacement or minor non-safety-critical changes, formal FAT/SAT or authority attendance may not be necessary where alternative documented testing and assurance arrangements are appropriate. This may include detector replacement, loop renewal or non-safety-critical configuration and timing changes.

Commissioning and acceptance activities should be undertaken by competent persons, with appropriate records retained as part of the asset documentation. Formal acceptance should confirm, where applicable, that the installation or change is safe, compliant, operational and fit for service.

2.7.5 Handover to Maintenance

Responsibility for the asset shall remain with the designer, installer, or works promoter until formal handover and acceptance by the highway authority has been completed. Any defects, non-compliances or outstanding works identified before handover shall be rectified in full before acceptance is granted.

Local Authorities should, where practicable, involve the maintenance service provider in commissioning and acceptance activities to support a smooth transition to operation, facilitate knowledge transfer and ensure familiarity with the asset, its equipment and maintenance requirements.

All handover documentation, including as-built records, test certificates, maintenance manuals, asset data, warranties and commissioning records, shall be complete, digitally available and incorporated into the authority's asset management system to support ongoing maintenance, inspection and statutory compliance.

Key Principle 13: Designers shall adopt a whole-life asset management approach, taking account of installation, operation, maintenance, renewal and decommissioning requirements during the design stage. Design decisions should seek to minimise future maintenance interventions, reduce whole-life costs, improve asset reliability and enhance the safety of both operatives and network users throughout the asset lifecycle.

2.8 Design: Effect of Foliage and Trees

The potential impact of trees and vegetation on the safety, operation, visibility, maintainability and whole-life cost of traffic control assets shall be fully considered during the design stage. Asset locations shall be selected to minimise future conflicts with existing and proposed vegetation, taking account of the anticipated growth of trees and shrubs throughout the design life of the asset, including canopy spread, mature height and root development.

Designers shall ensure that adequate clearances are maintained to preserve signal visibility, signage conspicuity, equipment access, electrical infrastructure, wireless communications, CCTV sightlines and maintenance activities. Where there is potential for conflict between highway technology infrastructure and trees, advice should be sought from a suitably qualified arboriculturist.

Design, installation and maintenance activities shall comply with relevant legislation, standards and guidance, including:

- BS 5837:2012 – Trees in Relation to Design, Demolition and Construction – Recommendations;
- BS 3998:2010 – Tree Work – Recommendations.
- NJUG Volume 4 – Guidelines for the Planning, Installation and Maintenance of Utility Apparatus in Proximity to Trees (current edition);
- The Highways Act 1980, where applicable; and
- Relevant health and safety legislation, including the Health and Safety at Work etc. Act 1974 and the CDM Regulations 2015.

Particular care shall be taken during excavation, installation and maintenance activities to avoid damage to roots, stems, branches and associated habitats. Works within Root Protection Areas (RPAs) should be minimised and trenchless or low-impact construction techniques should be considered wherever practicable to reduce the risk of harm to trees and associated infrastructure.

Authorities shall implement appropriate inspection and maintenance regimes to manage the ongoing interaction between vegetation and traffic control assets. This shall include monitoring and managing vegetation growth that may adversely affect visibility, signal sighting, road user safety, equipment access, electrical safety or asset performance. Maintenance requirements and vegetation management activities should be recorded within the authority's asset management system.

Vegetation management shall only be undertaken by personnel who are appropriately trained, competent and authorised. Routine maintenance operatives should be limited to minor clearance activities within their competence. Significant pruning, crown reduction, root works or tree removal shall be undertaken only by suitably qualified and insured arboricultural contractors in accordance with **BS 3998**, with specialist arboricultural advice obtained where necessary.

2.9 Specification of Low-Maintenance Components

Designers shall specify materials, equipment and technologies that minimise maintenance requirements, reduce whole-life costs and support safe, reliable operation throughout the asset lifecycle. Component selection shall be based on asset performance, maintainability, durability, resilience and value for money, while ensuring compliance with relevant legislation, standards and operational requirements.

When selecting components, consideration shall be given to:

- Durability, reliability and ease of maintenance;
- Availability of spare parts, technical support and long-term supplier resilience;
- Standardisation of equipment to support interoperability, stock rationalisation and efficient maintenance;
- Whole-life cost, including installation, operation, maintenance, energy consumption, renewal and disposal costs;
- Future-proofing and compatibility with existing and planned infrastructure.

Where reasonably practicable, designers should adopt solutions that reduce the need for intrusive maintenance activities and minimise disruption to the highway network. For example, above-ground detection technologies may be preferable to inductive loop systems where they provide equivalent operational performance and reduce ongoing maintenance liabilities.

Where systems incorporate equipment from multiple manufacturers, compatibility and interoperability shall be verified to ensure safe operation, effective maintenance, cybersecurity and long-term supportability. Open protocols and industry-standard interfaces should be used wherever practicable to minimise supplier dependency and facilitate future upgrades.

Designers should also consider the use of energy-efficient and extra-low voltage (ELV) technologies, including **LED signal aspects** and intelligent power management solutions, to reduce energy consumption, carbon emissions and whole-life operational costs. Electrical installations shall comply with the current edition of **BS 7671 (Requirements for Electrical Installations – IET Wiring Regulations)**, together with any other applicable standards, specifications and manufacturers' requirements.


Photo: Warwickshire County Council

2.10 Decommissioning Procedures

Authorities shall establish and maintain documented procedures for the safe and effective decommissioning of traffic control assets. Decommissioning shall be planned and managed in accordance with applicable legislation, including the **Health and Safety at Work etc. Act 1974, the CDM 2015**, environmental legislation and relevant highway authority requirements.

A site-specific Decommissioning Plan shall be prepared before the commencement of works. The plan should consider the asset's design, operational history, maintenance records, electrical installations, underground infrastructure, hazardous materials, traffic management requirements and any residual risks associated with removal activities. Appropriate risk assessments and method statements shall be completed and communicated to all parties involved.

Relevant stakeholders, including the highway authority, maintenance provider, utility companies, adjoining asset owners and affected road users, shall be informed of the proposed works, programme and anticipated impacts as appropriate.

Decommissioning activities shall be undertaken by competent persons and subject to appropriate supervision to ensure compliance with health, safety, environmental and technical requirements. Particular consideration shall be given to the safe isolation and removal of electrical equipment, disposal of materials, protection of underground apparatus and reinstatement of the highway.

On completion, the works shall be formally inspected and accepted by the highway authority. Asset records, drawings, inventory data, electrical certification, waste transfer documentation and any revised asset information shall be updated and retained in digital format as part of the authority's asset management system.

2.11 Records and Retention

Local Authorities shall establish and maintain robust record management arrangements for all traffic control assets throughout their lifecycle, including design, construction, commissioning, operation, maintenance, modification and decommissioning. Records shall include, as appropriate, design documentation, risk assessments, health and safety information, asset data, test and inspection records, maintenance histories, certificates, audit reports and decommissioning documentation.

Records shall be retained for an appropriate period following decommissioning, typically a minimum of **six years** or longer where required by legislation, contractual obligations, insurance requirements, incident investigations, claims defence, or operational needs. Consideration should also be given to the retention requirements of the **Limitation Act 1980, CDM Regulations 2015** and the authority's corporate records management policies.

All records shall be maintained in secure, accessible and auditable digital systems, forming part of the authority's asset management and information management arrangements. Record systems should support data integrity, version control, business continuity, regulatory compliance and efficient retrieval of information throughout the asset lifecycle.

Effective record retention is essential to support asset management, statutory compliance, risk management, incident investigation, future design and maintenance activities and the defence of insurance and legal claims.

2.12 Environmental and Sustainability Considerations

2.12.1 Energy Efficiency and Carbon Reduction

Authorities shall support the delivery of carbon reduction and sustainability objectives through the specification, operation and management of energy-efficient traffic control assets. Consideration shall be given to reducing whole-life environmental impacts while maintaining safety, operational performance, reliability and network resilience.

Designers and authorities should, where appropriate, specify energy-efficient technologies, including **LED signal aspects**, low-energy controllers, intelligent monitoring systems and ultra-low voltage (ELV) equipment. The potential use of renewable and alternative energy sources, such as solar power, should be considered where technically and economically feasible and where operational requirements can be met.

Technology selection shall consider whole-life performance, including energy consumption, maintenance requirements, embodied carbon, asset longevity, operational resilience and end-of-life impacts. Procurement decisions should seek to balance environmental benefits, value for money and long-term asset performance.

2.12.2 Waste Management

Authorities, designers and contractors shall minimise waste throughout the asset lifecycle in accordance with the principles of the **waste hierarchy: reduce, reuse, recycle, recover and dispose as a last resort**. Opportunities for the reuse, refurbishment and recycling of equipment, materials and components should be considered wherever practicable, provided safety, performance and compliance requirements can be maintained.

Materials removed during maintenance, renewal, or decommissioning activities shall be managed in accordance with applicable environmental legislation, duty-of-care obligations and the authority's waste management procedures. Disposal to landfill should be minimised wherever viable alternatives exist.

2.12.3 Operational Efficiency and Energy Management

Local Authorities may consider operational measures to reduce energy consumption and carbon emissions, particularly for non-critical assets and ancillary equipment. Such measures may include optimising operating schedules, dimming strategies, remote monitoring, adaptive control systems and other energy management initiatives.

Any proposed operational changes shall be subject to a documented assessment of road safety, network performance, accessibility, statutory obligations, asset resilience, whole-life costs and user impacts. Decisions shall be supported by appropriate risk assessments and approved in accordance with the authority's governance processes.

Where energy-saving measures are implemented, authorities should monitor performance to ensure that anticipated benefits are achieved without adversely affecting safety, operational effectiveness or service delivery.

2.13 Performance Management and Continuous Improvement

Authorities shall monitor maintenance and operational performance to ensure roadside technology assets remain safe, reliable and fit for purpose. A culture of continuous improvement should be embedded within both the authority and its service providers, supported by regular performance reviews, benchmarking, lessons learned and the adoption of industry best practice.

2.13.1 Continuous Improvement

Authorities shall adopt a structured approach to continuous improvement, supported by performance monitoring, benchmarking, lessons learned, innovation and the application of industry best practice. Opportunities to improve safety, asset performance, reliability, sustainability and value for money should be regularly reviewed and evaluated.

New technologies, processes and management approaches should be assessed against clearly defined business, operational and safety objectives before implementation. Adoption should be supported by evidence of benefit, risk assessment and consideration of whole-life costs, maintainability, interoperability and compliance with relevant standards.

2.13.2 Key Performance Indicators (KPIs)

Authorities shall establish and maintain a suite of **Key Performance Indicators (KPIs)** to monitor the performance of both the authority and its service providers. KPIs should align with corporate objectives, service policies, asset management strategies and contractual requirements.

Performance measures may include:

- Asset availability and operational reliability;
- Fault response and repair times;
- Planned maintenance completion rates;
- Health, safety and environmental performance;
- Customer and stakeholder satisfaction;
- Network performance and service resilience;
- Cost efficiency and value for money;
- Carbon reduction and sustainability objectives.

Performance data shall be regularly reviewed to identify trends, emerging risks, opportunities for improvement and the need for corrective or preventative action.

2.13.3 Performance Reporting

Authorities shall report performance against defined service standards and asset management objectives regularly. Reporting should provide meaningful information to support governance, decision-making, resource planning and continuous improvement.

Reports should include analysis of KPI performance, significant incidents, asset condition trends, service achievements, improvement initiatives and areas requiring management attention. Where appropriate, performance information should be made publicly available to promote transparency, accountability and stakeholder confidence.

Authorities should also benchmark their performance against comparable organisations and recognised industry standards to identify opportunities for improvement and share good practice.

Key Principle 14: Authorities should publish an annual assessment of performance against their Service Policy Statement, asset management objectives and applicable national and local performance indicators. The report should identify achievements, areas for improvement, planned actions and progress towards delivering a safe, reliable, sustainable and efficient traffic control service.

Section 3
Reactive and Proactive Maintenance



This section sets out the requirements for the effective management of reactive and proactive maintenance of roadside technology and associated systems. Maintenance activities shall support the highway authority's statutory duties under the TMA 2004, the Highways Act 1980 and wider network management responsibilities, ensuring that assets remain safe, reliable and operationally effective.

Reactive maintenance remains a critical function, providing a timely response to faults affecting roadside technology assets and supporting systems, including **UTMC, UTC** and remote monitoring systems. Effective fault response minimises disruption to network users, reduces operational risk and helps maintain public safety.

Maintenance contracts shall clearly define service requirements, including response and repair times, escalation procedures, performance standards, reporting obligations and communication arrangements.

At procurement and contract award stage, authorities shall satisfy themselves that contractors have the capability, capacity and resilience to deliver the required level of service. This should include evidence of:

- Robust fault management, diagnosis and repair processes;
- Adequate stocks of critical spare parts and resilient supply chains;
- Sufficient numbers of competent, trained and appropriately qualified personnel;
- Access to specialist technical resources where required; and
- Effective management systems covering health and safety, quality and asset management.

Key Principle 15: Authorities should ensure that maintenance contractors have appropriate procedures, resources, competencies and management arrangements in place to deliver an effective maintenance service in accordance with contractual requirements and agreed service levels.

3.1 Proactive Maintenance

Proactive (planned) maintenance is fundamental to effective asset management and shall form an integral part of the authority's lifecycle management strategy. A well-planned proactive maintenance regime reduces asset failures, improves reliability, extends asset life, supports compliance with statutory obligations and minimises whole-life costs.

Maintenance programmes shall be risk-based and informed by asset criticality, condition, age, manufacturer recommendations, operational requirements and applicable industry standards, including relevant **DMRB** requirements and recognised good practice.

Typical proactive maintenance activities include:

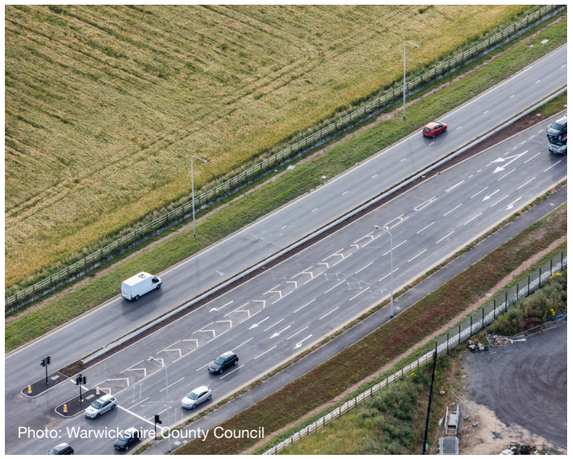
- Inspection and maintenance of signal heads, optical systems and visibility performance;
- Electrical inspection, testing and minor repairs in accordance with the current edition of **BS 7671;7671**;
- Structural and mechanical inspections of poles, posts, cabinets, foundations and associated infrastructure;
- Verification of asset condition, performance and operational functionality;
- Validation and updating of asset inventory data and records;
- Inspection of communications, detection and monitoring equipment; and
- Identification of emerging defects before they result in service failures.

Authorities shall define inspection frequencies, maintenance standards and performance requirements within maintenance contracts. These requirements shall be reviewed periodically to ensure they remain proportionate to asset age, condition, risk profile and operational importance.

Maintenance activities shall be planned and coordinated to maximise efficiency while maintaining safety and minimising disruption to network users. Personnel undertaking maintenance activities shall be competent for the tasks being performed, with specialist resources deployed where required.

All inspection findings, faults, maintenance activities, test results and asset condition information shall be recorded within a secure and accessible asset management system. Data should be regularly analysed to identify trends, support risk-based decision-making, inform future investment and drive continuous improvement.

Key Principle 16: Proactive maintenance should be regarded as a key element of effective asset management, helping to prevent asset failures, improve reliability, maintain safety and support the long-term performance of roadside technology and associated systems.


Photo: Warwickshire County Council

3.2 Maintenance Inspections

A structured programme of maintenance inspections is essential to effective, risk-based asset management. Inspections help identify defects, deterioration and performance issues before they affect safety, reliability or service delivery.

The objectives of maintenance inspections are to:

- Identify actual or emerging asset failures at an early stage;
- Detect physical deterioration and operational degradation;
- Maintain asset safety, reliability and availability in accordance with agreed service levels.

Reactive maintenance requirements should be managed through the authority's fault management procedures.

3.2.1 Inspection Scope

Maintenance inspections should, as a minimum, assess:

- Asset operation and performance against design and operational requirements;
- Electrical systems, including visual inspections and testing where required;
- The availability and accuracy of asset records, drawings and documentation;
- The physical condition and integrity of equipment, structures and foundations;
- Traffic signs and road markings associated with the asset;
- Environmental factors, including vegetation growth, obstructions and visibility issues affecting signals, CCTV, detectors or signs.

Inspection findings shall be recorded within the authority's asset management system and reviewed to support maintenance planning and lifecycle management.

3.3 Performance Monitoring

Inspection regimes should support the achievement of key performance indicators (KPIs), including:

- Planned inspection completion rates;
- Defects identified through planned maintenance;
- Asset condition improvements;
- Reduction in safety-critical failures.

3.4 Fault Management

3.4.1 Fault Management Framework

Authorities shall operate a documented and auditable fault management process to ensure assets remain safe, operational and available. The process should cover fault reporting, prioritisation, response, repair, verification and closure.

Modern fault management systems should use digital technologies, remote monitoring and performance reporting to support efficient service delivery and continuous improvement.

3.4.2 Fault Identification

Faults are typically identified through:

1. Planned Maintenance Inspections

Defects identified during inspections should be:

- Corrected immediately where practicable;
- Logged, categorised, and prioritised where additional work is required.

2. Remote Monitoring Systems (RMS)

Where available, remote monitoring systems should provide:

- Continuous monitoring of asset performance;
- Automatic fault detection and alert generation;
- Integration with the Fault Management System (FMS);
- Support for condition-based and predictive maintenance.

3. Third-Party Reporting

Faults may also be reported by:

- Members of the public;
- Police and emergency services;
- Public transport operators;
- Highway operations and maintenance teams.

Authorities should provide clear and accessible reporting channels, including online reporting tools and published contact details.

3.4.3 Fault Reporting Requirements

Fault reports should include sufficient information to support diagnosis and repair, including:

- Asset identifier (eg. SCN or equivalent);
- Asset location;
- Description of the fault;
- Any safety or operational implications;
- Date and time reported.

3.4.4 Fault Response and Resolution

Following fault identification, authorities or their contractors shall:

- Assess the severity and risk associated with the fault;
- Assign an appropriate priority level;
- Notify relevant stakeholders where necessary;
- Deploy resources within agreed response times;
- Monitor progress through to completion and closure.

Where practicable, a first-time fix approach should be adopted to minimise disruption and lifecycle costs.

3.4.5 Key Performance Indicators

Fault management performance should be measured against defined KPIs, including:

- Response time compliance;
- Repair completion times;
- First-time fix rates;
- Mean Time to Repair (MTTR);
- Repeat fault frequencies;
- Customer complaints and satisfaction levels.

3.4.6 Fault Prioritisation and Response

Faults shall be prioritised according to their impact on:

- Road user safety;
- Network operation and performance;
- Asset availability and resilience.

Maintenance contracts should define:

- Priority classifications;
- Target attendance and repair times;
- Contract operating hours;
- Service availability requirements.

Typical fault categories may include:

Fault Category	Priority
Safety-critical defects	Urgent
Signal failures or power loss	Urgent
Collision damage or vandalism	Urgent
Communications failures	Non-Urgent
Detector faults	Non-Urgent
Minor operational defects	Non-Urgent
Client-requested works	Chargeable

Authorities should establish response times appropriate to local requirements and contractual arrangements.

3.4.7 Emergency Response Arrangements

Authorities shall maintain arrangements for 24-hour fault reporting and emergency response.

These arrangements should include:

- Continuous access to fault reporting facilities;
- An out-of-hours contractor response service;
- Immediate attendance for safety-critical incidents;
- Measures to make the asset or site safe pending permanent repair.

Performance should be monitored against:

- Emergency response compliance;
- Time taken to make the site safe;
- Effectiveness of incident escalation and communication procedures.

3.5 Managing Underperformance

Persistent failure to meet agreed service standards can adversely affect safety, network performance, asset reliability and public confidence. Common causes may include:

- Poor quality workmanship;
- Non-compliance with health and safety requirements;
- Failure to achieve response or repair targets;
- Asset obsolescence or shortages of replacement parts;
- Inaccurate or incomplete asset records and inventory data.

Where performance issues are identified, authorities shall undertake a formal review to determine the root causes and appropriate corrective actions.

3.5.1 Performance Improvement Plans

Where sustained underperformance occurs, a formal **Performance Improvement Plan (PIP)** should be developed. The plan should include:

- Clearly defined improvement actions;
- Measurable performance targets and KPIs;
- Responsibilities and timescales for delivery;
- Arrangements for monitoring and review.

Progress shall be regularly assessed against agreed objectives and escalated where performance remains unsatisfactory.

3.5.2 Contract Management and Escalation

Authorities shall maintain effective contract management arrangements, including regular performance reviews and clear escalation procedures.

Where contractual performance standards are not achieved, authorities should:

- Notify the contractor in accordance with the contract;
- Maintain a clear audit trail of issues and actions taken;
- Monitor delivery of corrective measures;
- Apply contractual remedies where appropriate.

Contract termination should only be considered as a last resort after reasonable opportunities for improvement have been provided and documented.

3.6 Best Practice Principles

Authorities should seek to:

- Adopt risk-based and evidence-led maintenance strategies;
- Maximise the use of asset data, remote monitoring, and digital technologies;
- Promote efficient fault resolution and first-time fixes;
- Maintain high levels of asset availability and performance;
- Establish clear accountability and performance reporting arrangements;
- Drive continuous improvement through measurable KPIs and regular performance review.

3.6.1 On-Site Activities

Authorities shall ensure that maintenance contractors have effective fault diagnosis procedures and the necessary competence, equipment and resources to undertake repairs safely and efficiently. Contractors should be able to identify the root cause of faults, select appropriate repair methods, and restore assets to full operational, mechanical and electrical functionality.



Photo: Warwickshire County Council

Repairs shall be completed in accordance with relevant standards, manufacturer requirements and contractual obligations. Assets must be left in a safe, compliant and serviceable condition. Where required, sufficient time shall be allowed for inspection, testing and verification by the authority or its nominated representative to confirm that repairs have been completed satisfactorily.

Unsuccessful repairs resulting in repeat visits should be minimised, as they adversely affect service performance, increase costs and create unnecessary disruption.

3.6.2 Asset Condition Checks

When attending site, contractors should take the opportunity to undertake a visual asset condition check to identify any additional defects or deterioration affecting performance, safety or reliability. This may include:

- Optical defects and visibility issues;
- Mechanical damage or deterioration;
- Electrical defects or safety concerns;
- Signage and road marking issues;
- Vegetation or obstructions affecting asset performance.

Minor defects should be rectified during the visit where it is safe and practical to do so. The authority and contractor should clearly define within the contract the types of work that may be undertaken without prior approval and those requiring further authorisation, assessment, or programming.

Where asset information is incomplete or inaccurate, contractors should verify and update records during site visits to maintain the integrity of the authority's asset management system and, where applicable, **DCIS datasets.**

3.6.3 Maintenance Records

All faults, inspections and maintenance activities shall be recorded within the authority's FMS or equivalent asset management system. As a minimum, records should include:

- Asset identifier and location;
- Fault description;
- Actions undertaken;
- Date and time of attendance;
- Date and time of repair;
- Parts or materials used;
- Contractor or operative details;
- Outcome of the repair;
- Any follow-up actions required.

Accurate records provide an auditable history of maintenance activities, support asset management decisions, assist in defending insurance and legal claims, and help identify recurring issues and future maintenance needs.

3.6.4 Unsuccessful or Incomplete Repairs

Where a repair cannot be completed, or the fault remains unresolved, the contractor shall notify the authority and arrange a return visit within an agreed timescale. Maintenance contracts should clearly define response times and procedures for incomplete or unsuccessful repairs.

Contractors should investigate the reasons for failed repairs and implement corrective actions to prevent recurrence. Lessons learned should form part of the contractor's quality management and continuous improvement processes.

3.6.5 Verification and Quality Assurance

Contractors shall implement appropriate supervision and quality assurance arrangements to ensure that works are carried out in accordance with contractual requirements, method statements, relevant standards and safe working practices.

Authorities should verify that completed repairs achieve the required outcome and meet operational, safety and performance requirements. Verification may include inspection, functional testing, electrical testing, remote monitoring checks or review of maintenance records.

3.7 Compatibility of Equipment

Authorities and maintenance providers shall ensure that replacement components and assemblies are compatible with the existing asset and remain compliant with relevant standards, approvals and operational requirements. Particular care is needed when replacing equipment, especially where assets comprise components from different manufacturers or where legacy equipment is approaching obsolescence.

Before undertaking repairs or upgrades, contractors should verify that replacement equipment is compatible with the existing system architecture and will not adversely affect safety, performance, reliability, maintainability or interoperability. All replacement components should meet the relevant, manufacturer requirements and applicable industry standards.

Particular consideration should be given to older assets where replacement parts may no longer be available. In such circumstances, component replacement may not be feasible and a broader equipment upgrade or asset renewal may be required. Authorities should consider obsolescence risks as part of their asset management and lifecycle planning processes.

The introduction of new technologies can also create compatibility challenges. Examples include low-energy signal heads, detection systems, communications equipment and other intelligent transport systems that may require equipment to operate as an integrated system. Contractors should consult with the authority before installing alternative or upgraded components to ensure compatibility and maintain system performance.

3.8 UTMC, Open Standards and System Integration

Modern traffic management relies on the integration of multiple systems and data sources. **UTMC** enables information to be exchanged between traffic control systems and associated technologies, supporting coordinated network management and operational decision-making.

This may include integration with:

- Traffic signal systems;
- Variable Message Signs (VMS);
- Automatic Number Plate Recognition (ANPR) systems;
- Car park guidance systems;
- CCTV and monitoring systems;
- Environmental and traffic monitoring sensors.

Local Authorities should seek to adopt open standards and interoperable systems wherever practicable to avoid unnecessary vendor lock-in and support future innovation, competition and network integration.

The technical specifications previously maintained under UTMC are now largely managed through **TOPAS**, which provides the principal repository of open specifications for traffic management systems within the UK. Authorities and suppliers should utilise these specifications to support interoperability, consistency, and long-term maintainability.

As roadside technology continues to evolve, system integration should focus not only on technical connectivity but also on supporting operational outcomes, network management objectives, asset management strategies and wider transport policies. Authorities should therefore consider future compatibility requirements when specifying, procuring, maintaining and renewing assets.

Proactive Inspections and Testing:

3.9 Electrical Equipment Safety and Inspection

Authorities have a legal duty under the **Electricity at Work Regulations 1989** to ensure that electrical systems are maintained, so far as is reasonably practicable, to prevent danger.

To demonstrate ongoing electrical safety and compliance, roadside technology installations should be subject to periodic inspection and testing in accordance with the current edition of **BS 7671 – Requirements for Electrical Installations** and any applicable highway electrical standards.

The frequency of inspection and testing should be determined through a risk-based approach, taking account of:

- The type and complexity of the installation;
- The operational environment and usage;
- Inspection and maintenance history;
- Previous defects or test results; and
- External influences that may affect condition or performance.

As a general principle, electrical installations should be inspected and tested at intervals not exceeding **six years**, unless a shorter interval is justified by risk, condition or operational requirements.

Where practicable, electrical inspection and testing should be coordinated with other planned maintenance activities to minimise disruption and improve efficiency.

3.9.1 Visual Inspection of Electrical Equipment

A visual inspection of electrical equipment should be undertaken during each planned maintenance or repair visit. The purpose is to identify any condition that could affect safety, reliability or compliance.

Visual inspections should include, as appropriate:

- Condition of cabinets, wiring and electrical equipment;
- Signs of damage, deterioration, corrosion or water ingress;
- Integrity of earthing and bonding arrangements;
- Security of access doors and enclosures;
- Condition of fuses, circuit protection devices and labels;
- Evidence of overheating or electrical stress.

Any defects presenting an immediate danger shall be addressed without delay. Where an item of equipment is considered electrically unsafe and cannot be repaired immediately, it shall be isolated and taken out of service until appropriate remedial action has been completed.


Photo: Warwickshire County Council

Operatives undertaking visual inspections shall be appropriately trained, competent and capable of identifying electrical hazards and safety defects.

3.9.2 Electrical Testing

Electrical testing shall only be undertaken by competent persons with the necessary training, qualifications, knowledge and experience to safely carry out testing and interpret the results.

All test equipment shall be:

- Suitable for the intended purpose;
- Properly calibrated;
- Maintained in accordance with manufacturer requirements; and
- Subject to appropriate certification and inspection.

Testing shall confirm that the installation remains safe, compliant and suitable for continued operation. Any non-compliances, observations or departures from standards shall be recorded and managed through the authority's maintenance procedures.

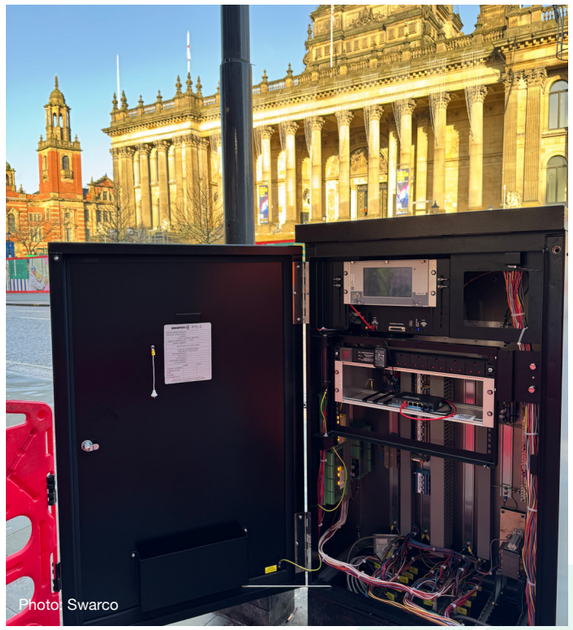
3.9.3 Certification and Record Keeping

The results of electrical inspections and testing shall be recorded on appropriate certificates and retained as part of the asset record.

Authorities should maintain records electronically wherever possible to support efficient asset management, auditing, compliance monitoring and lifecycle planning. Digital certification systems and asset management platforms, including **DCIS** where applicable, should be used to link inspection and test records directly to individual assets.

Electrical inspection records shall be retained throughout the life of the asset and used to:

- Demonstrate compliance with statutory requirements;
- Monitor asset condition and deterioration;
- Inform maintenance and renewal programmes;
- Support risk management and claims defence; and
- Verify the effectiveness of maintenance strategies.


Photo: Swarco

3.10 Structure Inspection and Assessment

3.10.1 Inspection and Assessment of Protective Coatings

Traffic signal posts, cabinets, poles and other roadside technology assets shall be protected against corrosion and environmental deterioration throughout their service life.

Protective coatings, including galvanising, paint finishes and anti-vandal coatings, shall be inspected during routine maintenance visits. Any signs of corrosion, damage or coating failure shall be recorded and remedial action taken where necessary.

New and replacement assets should be specified with appropriate protective finishes to suit their location, environment and expected design life.

3.10.2 Visual Structural Inspections

A visual inspection of posts, columns and supporting structures shall be undertaken during routine maintenance visits to identify:

- Corrosion and material deterioration;
- Mechanical damage or deformation;
- Foundation or root corrosion issues;
- Missing or defective fixings;
- Signs of instability.

Inspection findings shall be recorded and used to inform future maintenance, repair or replacement programmes.

3.10.3 Structural Testing

Visual inspections alone may not identify hidden or below-ground defects. Authorities should therefore undertake additional structural testing where justified by asset age, condition, location or risk.

Testing may include:

- Ultrasonic testing;
- Non-destructive testing (NDT);
- Foundation or root condition assessments;
- Specialist structural assessments.

Testing programmes should be risk-based and targeted towards older or higher-risk assets.

Where significant deterioration is identified, authorities shall take appropriate action, including repair, increased monitoring, strengthening or replacement.

3.10.4 Record Keeping

All inspection, testing and assessment results shall be recorded within the asset management system and used to support lifecycle planning and risk management.

3.11 Traffic Signal Lamp Replacement and LED Conversion

Traffic signal maintenance has historically relied on either bulk replacement of halogen lamps at planned intervals or a replace-on-failure approach. However, the long-term availability of halogen signal lamps is uncertain, owing to the phased withdrawal of halogen lighting technologies and the increasing adoption of energy-efficient alternatives.

Authorities should therefore plan for the progressive replacement of halogen signal aspects with **LED technology** as part of their asset management and renewal strategies.

LED signal aspects offer significant benefits, including:

- Improved reliability and reduced maintenance requirements;
- Lower energy consumption and operating costs;
- Longer service life;
- Improved asset availability;
- Reduced carbon emissions and support for sustainability objectives;

To manage the transition effectively, authorities should:

- Continue to replace halogen lamps on failure where appropriate to conserve remaining stock;
- Develop or accelerate LED conversion programmes;
- Review renewal and investment strategies to maximise the benefits of LED and low voltage technologies;
- Consider energy savings, maintenance reductions and whole-life costs when prioritising upgrades.

Priority should be given to assets where continuous illumination is essential for safety and regulatory compliance, including:

- Traffic signals;
- Pedestrian and cycle crossing signals;
- Illuminated traffic signs;
- Variable Message Signs (VMS) used for safety-critical information.

Authorities should adopt a planned migration strategy to LED technology, aligned with their asset management plans, lifecycle replacement programmes, carbon reduction objectives and funding availability.

Key Principle 17: Authorities should prioritise the replacement of ageing halogen signal technology with LED alternatives, where technically and economically practicable, to improve reliability, reduce energy and maintenance costs, and support long-term asset sustainability.
Authorities should assess whether retrofit solutions are appropriate or whether full modernisation is required, taking account of the condition and compatibility of controllers, cabling and associated equipment, together with obsolete or no longer prescribed signal arrangements and physical layouts that may require upgrading to meet current design requirements, including Traffic Signs Manual Chapter 6. This assessment should inform a proportionate, risk-based and whole-life approach to investment and renewal.



Photo: Clearview Intelligence

3.12 Mechanical Inspections

Mechanical components that are critical to the safe and reliable operation of roadside technology assets shall be inspected as part of the authority's planned maintenance regime. Inspections should assess the condition, security and functionality of equipment to identify defects before they affect performance or safety.

As a minimum, inspections should include:

- Asset cabinets, doors, hinges, locks and fixings;
- Signal poles, brackets, mounting arrangements and access covers;
- Security devices and anti-vandal measures;
- Mechanical equipment associated with the asset.

Any defects identified shall be recorded and rectified in accordance with the authority's maintenance procedures and the manufacturer's recommendations.

Repairs and adjustments shall only be undertaken by suitably trained and competent personnel. Where specialist skills or equipment are required, appropriately qualified contractors shall be engaged.

All inspection findings, maintenance activities, repairs and component replacements shall be recorded within the asset management system to provide a complete maintenance history and support lifecycle asset management.

3.13 Registers, Inspection Schedules and Records

3.13.1 Asset Register

Authorities shall maintain an accurate and up-to-date **asset register** for all roadside technology assets. The register should form part of the authority's asset management system and provide the basis for planned maintenance, inspections, renewals and lifecycle management.

As a minimum, the asset register should include:

- Unique asset reference number;
- Asset location;
- Asset type and equipment details;
- Installation and modification history; and
- Asset status (active, proposed, or decommissioned).

Asset registers should be reviewed regularly to ensure that new, modified, and decommissioned assets are accurately recorded.

3.13.2 Inspection Schedules

Authorities shall establish planned maintenance schedules based on asset type, condition, criticality and contractual requirements. Inspection programmes should be organised to maximise efficiency, reduce travel time, minimise environmental impacts and deliver value for money.

Maintenance contracts should define inspection frequencies and completion requirements. Planned inspections should normally be undertaken within an agreed inspection window to provide flexibility while maintaining compliance with the maintenance programme.

3.13.3 Inspection Records

Contractors shall provide a complete digital record of all inspections, tests and maintenance activities undertaken.

Inspection records should include, where applicable:

- Cyclical inspection reports;
- Electrical inspection and test certificates;
- Structural inspection or testing reports;
- Asset-specific certification;
- Photographs of defects, risks, and completed works.

All records shall be stored within the authority's asset management system and be readily accessible for audit, maintenance planning and compliance purposes.

3.13.4 Asset Documentation

Authorities shall maintain accurate and up-to-date asset documentation to support safe operation and maintenance.

Typical asset documentation includes:

- Site layouts and drawings;
- As-built information;
- Equipment configurations and wiring details;
- Operational settings and parameters;
- Health and safety information;
- Maintenance and inspection history.

Contractors should periodically verify documentation against site conditions and report any discrepancies, missing information or required updates.

Where practicable, documentation should be maintained in digital format and integrated with asset management systems, including **DCIS** where applicable.

3.13.5 Document Retention

Authorities should retain comprehensive lifecycle records for each asset, including:

- Design and construction information;
- Risk assessments and safety documentation;
- Inspection and maintenance records;
- Fault history and performance data;
- Asset-specific technical information.

Records shall be stored in secure and accessible electronic systems to support asset management, statutory compliance, audits, investigations and claims defence.

3.14 Safety

The Authorities and contractors shall ensure that all inspection and maintenance activities are undertaken in accordance with applicable health and safety legislation, including the **Health and Safety at Work etc. Act 1974**, the **Management of Health and Safety at Work Regulations 1999**, and the **CDM 2015**.

Contractors shall maintain suitable and sufficient **risk assessments** and **safe systems of work** for routine inspection and maintenance activities. These documents should identify foreseeable hazards and define measures to eliminate or reduce risks so far as is reasonably practicable.

Authorities shall also maintain and communicate any **site-specific risks** associated with individual assets. Contractors should review these risks before commencing work and report any new or changed hazards identified during site visits.

3.14.1 Confined Spaces and Hazardous Atmospheres

Where assets include confined spaces or enclosed equipment cabinets, appropriate procedures shall be in place to identify and manage the risks associated with hazardous atmospheres, including explosive or asphyxiating gases.

Authorities should establish clear procedures for responding to the detection of hazardous gases and maintenance contracts shall specify the methods and competence requirements for gas testing where necessary.

3.14.2 Vermin and Biological Hazards

Authorities and contractors should recognise the potential risks associated with vermin infestations within roadside technology assets. Risks may include equipment damage, contamination and exposure to diseases such as **Leptospirosis (Weil's Disease)**.

Assets should be designed, installed and maintained to minimise vermin ingress through appropriate sealing of cabinets, poles, chambers and duct entries.

Where infestations are identified, contractors shall follow approved risk assessments and safe working procedures. Specialist pest control services should be employed where necessary.

3.14.3 Competence and Supervision

Personnel carrying out inspections and maintenance activities shall be trained, competent and authorised for the tasks they undertake. Appropriate supervision shall be provided to ensure compliance with safety procedures, contract requirements and industry best practice.

3.14.4 Monitoring and Review

Safety risks identified during inspections shall be recorded and managed through the authority's asset management and health and safety processes. Risk assessments should be reviewed periodically and updated when site conditions, equipment or working practices change.

3.15 Communication Faults

Standard practice for the design and installation of most assets includes the provision of a telecommunications link to the RMS instation. There are several types of telecommunication services including:

- Mobile communication services, including legacy 3G systems and current 4G/5G services;
- Broadband Internet Protocol (IP) Addressed Circuits;
- Wireless communications; and
- Fibre Optic Cable.

Each communication type is provided by a Communication Service Provider (CSP). If faults occur with the communication to site, the following generic fault reporting process should be followed:

- Report the fault to the maintenance contractor to eliminate the possibility of the fault occurring within an authority's remote monitoring equipment or network management systems. Once the outstation equipment has been checked, there is more certainty that the fault lies with the service provided by CSP;
- Report a fault to the CSP using the agreed process under the service agreement between the authority and CSP;
- If the fault is rectified by the CSP, then the fault should be closed on the FMS. If further investigation is required, the authority should continue to manage the fault closely, obtaining regular updates from the CSP;
- If the fault requires both the CSP and the contractor to attend site together this should be arranged using the fault management process.

Response times for repairs will be different from authority to authority, as they are dependent on the local service level agreement between the authority and the CSP. Typical communication issues include:

Mobile communication: The complexity of systems and the growth of IP-based communications favour the use of mobile communication. Both public and private networks are currently available. Issues can arise from lack of connectivity and signal drop-out, particularly as network providers typically offer only 85% availability on their SIM profiles.

Broadband IP-addressed circuits: Issues can relate to reduced broadband line speed, affecting performance for large data packets such as CCTV images. A lack of communications may be due to a fault on the associated broadband line. The same reporting process should be followed to report the fault to the CSP.

Wireless: Loss of wireless communications can have several causes, including the loss of repeater equipment or access points needed to carry the wireless signal or a misaligned or damaged antenna. Cable deterioration owing to the environment can also cause problems, since systems typically use Category 5, 5e (Enhanced) or 6 cables to connect equipment.

Fibre Optic Cable: Issues can relate to reduction of performance on the cable, affecting packets of information, such as UTC data and CCTV images. Loss of communication might be due to a fault on the cable, and the same reporting process should be followed to report the fault to the CSP.

Equipment can also develop communication problems owing to issues such as faulty modem equipment or wear and tear on cable and communication sockets. These issues should be investigated by the maintenance contractor and resolved under the local agreement.


Photo: Warwickshire County Council

3.16 Traffic Signals and Crossing Signals

3.16.1 Introduction

This section applies to:

- Traffic signal junctions; and
- Signal-controlled crossings, including **Puffin, Pedex, Toucan pedestrian and cycling crossings, Equestrian crossings** and legacy **Pelican** crossings.

Authorities shall ensure that faults affecting these assets are identified, prioritised and rectified promptly to maintain road safety, accessibility and network efficiency.

3.16.2 Signals Not Operating (Lamps Off or All Out)

A complete or partial loss of signal displays is a safety-critical fault that may result from equipment failure, power supply interruptions, communications issues or planned third-party works.

Such faults shall be treated as urgent and responded to within the timescales defined in the maintenance contract.

Where signals are not operational, authorities should consider appropriate risk mitigation measures, including:

- Temporary signing in accordance with the **Traffic Signs Manual**;
- Informing relevant stakeholders and network operators;
- Public communications where significant disruption is expected; and
- Temporary traffic management where required to maintain safety.

Authorities should ensure that procedures are in place for the safe isolation, bagging or switch-off of signals during planned works.

3.16.3 Detector Faults

Traffic signal performance relies on effective vehicle, pedestrian, cycle and equestrian detection. Faulty detection can adversely affect junction operation, crossing performance, journey times and overall network efficiency.

Detection equipment should be monitored through **Detector Fault Monitoring (DFM)** facilities within approved traffic signal controllers and, where available, connected Remote Monitoring Systems (RMS).

Common faults include:

- Permanent detection;
- Permanent non-detection;
- Detector alignment issues;
- Communications faults; and
- Equipment damage or vandalism.

Faults shall be prioritised according to their operational and safety impact. Defects causing unnecessary crossing calls, inefficient signal operation or safety concerns should be treated as higher-priority faults.

Detection equipment shall be maintained in accordance with manufacturer requirements and relevant TOPAS **specifications**.

Overhead detectors should be inspected periodically to ensure correct alignment, security and physical condition, particularly following severe weather or vandalism incidents.

3.16.4 Lamp and Signal Aspect Faults

Signal aspect failures shall be prioritised according to their risk to road users and network operation.

3.16.5 Red Signal Aspect Faults

Failures affecting red signal aspects shall be treated as **urgent faults** because of their potential impact on safety.

Particular attention should be given to failures affecting secondary red aspects or arrangements that may prevent safe signal operation or crossing functionality.

3.16.6 Other Signal Aspect Faults

Failures of non-red signal aspects, wait indicators, regulatory signs and similar equipment should be assessed and prioritised according to their operational impact and contractual requirements.

3.16.7 Illuminated Signs and Regulatory Equipment

Faults affecting illuminated signs, internally illuminated regulatory signs and similar equipment should be recorded and repaired within agreed maintenance timescales.

3.16.8 Asset Renewal and LED Conversion

Where maintenance is undertaken on signal heads mounted on tall poles or difficult-to-access structures, authorities should consider replacing all signal aspects on that structure during the same visit where this represents a safe and cost-effective approach.

Authorities should continue to support the migration from legacy halogen technology to **LED signal aspects** as part of planned renewal programmes. Benefits include:

- Improved reliability;
- Reduced maintenance requirements;
- Lower energy consumption;
- Reduced whole-life costs; and
- Improved sustainability performance.

LED signal aspects should be maintained and monitored in the same manner as other signal equipment, with faults recorded and managed through the authority's fault management system.



Photo: Warwickshire County Council

3.16.9 Persistent Faults

Recurring or repeat faults shall be investigated to identify the underlying cause and prevent further occurrences. Authorities should require maintenance contractors to undertake root-cause analysis where persistent faults are identified and implement appropriate corrective actions.

3.16.10 Remote Monitoring Systems

Following any repair or component replacement, contractors shall ensure that the traffic signal controller, RMS, UTC or UTMC system correctly recognises the repaired equipment and that all monitoring functions are fully operational.

Continuous monitoring should be used wherever practicable to support proactive maintenance, improve asset availability, and reduce network disruption.

3.16.11 Signal Head Visibility and Alignment

The visibility and alignment of traffic signal and crossing signal heads shall be inspected as part of routine maintenance and in accordance with the Traffic Signs Manual, Chapter 6 – Traffic Control.

Signal aspects shall be clearly visible to the intended road user from the appropriate approach distance and shall not be obscured by vegetation, street furniture, signs, parked vehicles or other obstructions.

Maintenance inspections should verify:

- Correct alignment and orientation of signal heads;
- Adequate visibility of signal aspects;
- Compliance with operational and safety requirements; and
- The absence of obstructions affecting visibility.

Particular attention shall be given to vegetation growth. Where foliage, branches, or other vegetation may impair signal visibility, appropriate remedial action shall be initiated. As a guide, vegetation within **1.5 metres** of a signal head should be assessed and managed to ensure signal visibility is maintained.

Any visibility issues identified during inspections shall be recorded and reported through the authority's maintenance management process, with corrective action prioritised according to the level of safety risk.

3.16.12 Operational and Timing Issues

Operational and timing faults are often reported by road users, stakeholders or network operators where traffic signals are perceived not to be operating as intended. These issues may relate to signal timings, detector operation, adaptive control systems, pedestrian facilities or general junction performance.

All reports should be assessed to determine whether a genuine fault exists or whether the signals are operating in accordance with their approved design and operational strategy. Initial investigations should use available data sources, including Remote Monitoring Systems (RMS), UTC/UTMC systems, fault logs, detector data, and, where necessary, site inspections.

Where a fault is confirmed, it shall be recorded within the **FMS** and assigned for investigation or repair. Where no fault is identified, the report should still be logged to allow trend analysis and the identification of recurring operational concerns.

3.16.13 Signal Timings and Operational Settings

Authorities are responsible for ensuring that signal timings and operational settings comply with current standards, approved designs, local policies and network management objectives.

Particular attention shall be given to safety-critical parameters, including:

- Intergreen periods;
- Pedestrian clearance periods;
- Minimum green times;
- Detector settings affecting safety functions; and
- Crossing operation parameters.

Any safety-critical changes shall be formally reviewed, approved, documented and implemented without undue delay.

Non-safety-critical adjustments, such as cycle times, stage demands, maximum green settings or optimisation parameters, may be implemented to improve network performance. All changes should be documented, controlled and retained within the authority's asset and configuration management systems.

It is recommended that the traffic signal junctions should be validated every five years or after significant changes to the use or alteration to the highway network.

3.16.14 Planned Works and Temporary Conditions

Where planned highway works, resurfacing activities, utility works or third-party activities affect signal operation or detection equipment, authorities should coordinate repairs, reinstatement and optimisation activities to minimise disruption and avoid repeat visits.

Temporary operational arrangements should be monitored and reviewed to ensure continued safe and efficient operation until permanent repairs or reinstatement works are completed.

3.16.15 Fallback and Resilience Arrangements

Authorities should ensure that traffic signal controllers have validated fallback operating modes to maintain safe operation if the primary control strategy becomes unavailable.

This may include fallback from:

- **SCOOT;**
- **MOVA.**

3.16.16 Adaptive Signal Control Systems

Fallback operation should be regularly reviewed and tested to ensure it provides an acceptable level of safety and network performance until full functionality is restored.

3.16.17 Push Button Units – Audibles and Tactile Signals

Push-button units at signal-controlled crossings may incorporate **audible indicators, rotating tactile cones**, or both, to assist visually impaired pedestrians in identifying when it is safe to begin crossing. Pedestrian detection and push-button demand systems should, where technically appropriate, be configured to fail to a safe operational state, including maintaining or generating pedestrian demand where loss of detection could otherwise prevent or adversely affect the pedestrian crossing facility.

These facilities form an important part of the authority's duties under the **Equality Act 2010** and should be maintained to ensure continued accessibility and safe use of crossing facilities.

Modern push button units can be monitored remotely through **RMS**, enabling faults to be identified more quickly and reducing reliance on site inspections or reports from members of the public.

Faults affecting audible or tactile crossing facilities can significantly impact visually impaired users and may make the crossing less accessible. Authorities should therefore classify such faults as **high-priority faults** and ensure that repairs are undertaken within the timescales defined in the maintenance contract.

Where RMS monitoring is available, authorities should use automatic fault reporting and performance monitoring to support proactive maintenance and improve asset availability.

Following repair, contractors shall verify that audible and tactile facilities are fully operational and that any associated monitoring systems correctly recognise the restored equipment.

3.17 Traffic Signals – Other Signal Installations

3.17.1 Introduction

This section applies to specialist traffic signal installations, including:

- **Equestrian crossings,** which provide a controlled crossing facility for horse riders;
- **Sparrow crossings,** which provide dedicated crossing facilities for cyclists and where required, incorporate provision for pedestrians;
- **Wig-wag signals** used at level crossings, swing or lifting bridges, airfields and emergency service facilities; and
- **School Crossing Patrol (SCP) flashing amber warning signs.**

These assets shall be maintained in a safe and operational condition in accordance with the relevant legislation, standards, manufacturer requirements and highway authority policies.

3.17.2 Equestrian Crossings

Equestrian crossings provide dedicated facilities for horse riders and shall be maintained to ensure safe operation for all users. Particular attention should be given to push-button units, signal displays, detection systems and crossing timings to ensure compliance with the approved design and operational requirements.

3.17.3 Sparrow crossings

Sparrow crossings provide dedicated crossing facilities for cyclists and where required, incorporate provision for pedestrians. They shall be maintained to ensure safe operation for all users, with particular attention to signal displays, detection systems, red-lamp monitoring and crossing timings, in accordance with the approved design, operational requirements and any required special authorisation.

3.17.4 Wig-Wag Signals

Wig-wag signals are safety-critical assets and shall be subject to appropriate inspection, monitoring and maintenance arrangements. Faults affecting signal operation, visibility, illumination or control equipment shall be treated as high-priority defects and rectified within the timescales specified by the maintenance contract.

Equipment should comply with relevant **specifications**, including those applicable to wig-wag signal control equipment and be maintained in accordance with manufacturer recommendations.

3.17.5 School Crossing Patrol Signs

School Crossing Patrol flashing amber warning signs shall be maintained to ensure reliable operation during school arrival and departure periods.

Authorities shall ensure that annual operating schedules are reviewed and updated to reflect:

- School term dates;
- Public holidays;
- Teacher training days; and
- Other planned school closures.

Maintenance contracts should define responsibility for updating operational calendars and verifying that programmed times remain accurate. Where remote management facilities are available, authorities should make use of them to improve efficiency and reduce maintenance visits.



Photo: Swarco

3.17.6 Standards and Guidance

Authorities should ensure that these assets are designed, operated and maintained in accordance with:

- **Traffic Signs Regulations and General Directions (TSRGD)**;
- **Traffic Signs Manual – Chapter 6: Traffic Control**;
- Relevant TOPAS **Specifications**;
- Manufacturer instructions; and
- Local highway authority requirements.

3.18 Interactive Signs

Interactive signs are used where additional driver awareness is required and conventional signing alone may be insufficient. Common applications include speed management, school safety and warning of specific hazards.

This section covers Vehicle Activated Signs (VAS), Electronic Message Signs (EMS) and time-activated signs. These may operate using vehicle detection, programmed timetables or other approved activation methods to display warning signs and supplementary messages.

Authorities should ensure interactive signs are specified, installed and maintained in accordance with current TSRGD requirements, manufacturer guidance and relevant specifications, including current **TOPAS 2541B – Performance Specification for Control Systems for Vehicle Activated Discontinuous Variable Messages.**

Maintenance frequencies should be based on local asset management strategies, risk assessments, manufacturer recommendations and operational requirements.

Where above-ground detectors are used, maintenance requirements will vary depending on whether the detector is integrated within the sign assembly or installed as a separate unit. Particular attention should be given to alignment, environmental exposure, component availability and long-term maintainability.

For solar- or wind-powered installations, authorities should monitor power performance and ensure assets are suitably located to achieve reliable battery charging throughout the year.

Operational issues may arise from controller faults, configuration errors or incorrect timetable settings. Authorities should maintain clear, site-specific contingency arrangements to manage failures safely until normal operation is restored. Faults should be investigated and rectified in accordance with manufacturer instructions and local maintenance procedures.

3.18.1 Proactive Maintenance

Routine inspections should include:

- Verification of sign operation and configuration;
- Checking vehicle detection equipment and trigger thresholds;
- Confirmation that timetable-controlled signs operate at the correct times and dates;
- Inspection and testing of inductive loop detection systems;
- Cleaning of sign faces using approved methods and materials;
- Inspection of sign visibility, alignment and overall condition;
- Identification of vegetation or other obstructions affecting visibility and arrangement for remedial action;
- Recording of defects, repairs and maintenance activities within the asset management system.

All inspections and maintenance activities should follow manufacturer guidance and support safe, reliable, and effective operation throughout the asset lifecycle.

3.19 Variable Message Signs

Variable Message Signs (VMS) enable authorities to provide real-time information to road users, including traffic incidents, congestion, roadworks, weather conditions, events, parking availability and journey times. As safety-related traffic signs, VMS should incorporate fault monitoring and be maintained to ensure reliable operation.

VMS are typically either:

- **Electromechanical signs** using rotating planks or prisms to display pre-defined messages;
- **Electronic Message Signs (EMS)** using LED technology to display approved messages, symbols and graphics.

Authorities should ensure VMS are designed, installed, operated and maintained in accordance with **TSRGD**, relevant **specifications**, manufacturer guidance and local asset management policies.

Where practicable, VMS should be integrated with a **UTMC or equivalent control system** to enable remote monitoring, fault reporting and operational control. Stand-alone signs may also be used but provide reduced monitoring capability.

3.19.1 Design and Maintenance Considerations

Safe access for inspection and maintenance should be considered at the design stage. As VMS are often located adjacent to live carriageways and mounted at height, maintenance activities must be supported by appropriate risk assessments, traffic management and safe systems of work.

Authorities and contractors should identify site-specific risks, equipment types and maintenance requirements before undertaking work. Environmental factors, including adverse weather, should also be considered, particularly where access doors, moving components or exposed equipment may be affected.

Many VMS incorporate environmental controls such as heaters and thermostats. These should be maintained in accordance with manufacturer recommendations to ensure reliable operation and maximise asset life.

Flashing lanterns, where prescribed by TSRGD or authorised for specific applications, should be routinely inspected and maintained to ensure continued performance.

Modern full-colour LED matrix signs may also support connected vehicle technologies, including **In-Vehicle Message Signing (IVMS).**

3.19.2 Equipment-Specific Maintenance

3.19.3 LED VMS

Common faults include:

- LED display failures;
- Brightness or dimming control faults;
- Controller or communication failures.

Repairs should be carried out in accordance with manufacturer requirements, typically by replacing LED modules rather than individual LEDs. Following repair, operational and brightness tests should be undertaken to confirm full functionality.



Photo: Swarco

3.19.4 Proactive Maintenance

Inspection frequencies should be based on local service levels, asset criticality, manufacturer recommendations and operational requirements.

Routine inspections should include:

- Verification of sign operation and displayed messages;
- Inspection of sign alignment and visibility;
- Cleaning of sign faces;
- Inspection and cleaning of solar panels, where fitted;
- Checks of heaters, thermostats and environmental controls;
- Inspection of access doors, seals, hinges and locks;
- Testing of communication, monitoring, and fault-reporting systems;
- Inspection of mechanical components on rotating plank or prism signs;
- Recording of defects, repairs and maintenance activities within the asset management system.

After testing, signs should be returned to their normal operational state.

3.19.5 Current relevant Standards and Guidance

- **TOPAS 2516D** - Performance Specification for Discontinuous Variable Message Signs;
- **TOPAS 2517C** - Performance Specification for Electromechanical Message Signs;
- **TSRGD** and associated traffic sign guidance;
- **ARTSM Guidance on the Application of Mobile, Temporary and Permanent VMS (2021)**;
- Manufacturer-specific operation and maintenance requirements.

All maintenance activities should support the safe, reliable and effective operation of VMS assets throughout their lifecycle.

3.20 Fixed Enforcement / Road Safety Cameras

Fixed enforcement and road safety cameras are deployed where road safety, traffic management or traffic regulation compliance issues have been identified. Many authorities manage these assets through **Safety Camera Partnerships** or **Road Safety Partnerships**, supporting wider road safety objectives and casualty reduction programmes.

Common camera types include:

- **Speed cameras** – enforcing speed limits, including fixed and average speed systems;
- **Red-light cameras** – monitoring compliance at signal-controlled junctions;
- **Bus lane and bus gate cameras** – enforcing access restrictions and authorised vehicle use.

Enforcement camera systems used for legal proceedings shall comply with applicable legislation, including the Road Traffic Offenders Act 1988. Where equipment is a prescribed device, evidence is admissible under section 20 only where the device is of a type approved by the Secretary of State and any conditions of that approval are satisfied.

Authorities should ensure applicable equipment has appropriate Home Office Type Approval (HOTA) and is operated in accordance with the conditions of that approval. Asset management and renewal planning should reflect current Home Office requirements and consider equipment obsolescence, ongoing support, availability of approved replacement technology and the implications of the type-approval process for timely asset replacement.

Authorities should ensure that installation, operation, maintenance, calibration and inspection activities comply with any conditions attached to the equipment's Type Approval, manufacturer requirements and relevant partnership agreements.

3.20.1 Maintenance and Operational Considerations

Some Type Approval conditions restrict certain maintenance, repair or configuration activities to the equipment manufacturer or authorised personnel. Authorities should ensure maintenance arrangements do not compromise compliance, as this could affect the admissibility of enforcement evidence.

Modern digital enforcement systems provide enhanced image quality, remote diagnostics, secure data transmission and reduced site attendance requirements. Where remote monitoring is available, authorities should use fault reporting and diagnostic capabilities to support efficient asset management and minimise operational disruption.

All camera assets should be maintained in accordance with manufacturer guidance, local procedures and relevant statutory requirements to ensure continued reliability, accuracy and evidential integrity.

3.20.2 Equipment Specific Issues

Vandalism is a common cause of safety camera faults. Authorities should ensure maintenance contractors have the necessary competence, training and authorisations to safely repair damaged equipment while maintaining evidential integrity and compliance with Type Approval requirements.

Where vandalism occurs, priority actions should include:

- Making damaged equipment safe;
- Isolating electrical supplies where necessary;
- Securing or recovering enforcement equipment and associated data;
- Recording and reporting incidents in accordance with local procedures.

Red-light enforcement systems are often integrated with traffic signal installations and may require coordination with the relevant highway authority or asset owner before maintenance is undertaken.

Some legacy red-light camera systems use inductive loop detectors, while newer systems use fully digital vehicle detection technologies. Where loops are present, deterioration of the carriageway or third-party damage can affect performance and should be promptly repaired.

When upgrading traffic signal equipment, particular care should be taken to ensure compatibility between enforcement systems and modern low-power LED signal aspects or distributed controller architectures.

Unlike many ITS assets, enforcement cameras are not always connected to remote monitoring systems. Consequently, regular inspections are required to identify faults and deterioration. Any additional monitoring arrangements should be assessed against the conditions of the equipment's Type Approval.

Average speed camera systems use Automatic Number Plate Recognition (ANPR) technology and are frequently mounted on tall poles or mast-arm structures. Maintenance activities involving these assets require specific risk assessments, safe access arrangements and appropriate traffic management. Authorities should consider adopting a two-person attendance policy for maintenance activities where justified by local risk assessments.

3.20.3 Proactive Maintenance

Authorities and contractors should maintain enforcement camera systems in accordance with:

- Home Office Type Approval requirements;
- Manufacturer recommendations;
- DfT Circular 01/2007 Use of Speed and Red-Light Cameras for Traffic Enforcement;
- Local partnership and maintenance agreements.

Some Type Approved systems require maintenance, calibration or recommissioning by the manufacturer or authorised personnel. Authorities should ensure maintenance arrangements preserve the approval status of the equipment.

Routine preventative maintenance should include:

- Verification of system operation and communications;
- Inspection and cleaning of camera lenses and optical components;
- Inspection of cabinets, poles, mountings and electrical equipment;
- Checks of carriageway loops and associated detection equipment, where fitted;
- Inspection of stop lines associated with red-light enforcement systems;
- Verification that secondary speed-check markings remain clearly visible;
- Review of asset condition, security and evidence storage arrangements.

Where periodic calibration is required, calibration records should be retained within the asset management system. Records should include calibration dates, equipment serial numbers, certification details and authorised signatures to support evidential requirements.

Following maintenance, the system should be tested to confirm correct operation and all results recorded in the maintenance records.

For average speed camera installations, authorities should ensure that maintenance requirements, safe access provisions, traffic management needs, and any lane closures are considered during the design, installation and operational phases of the asset lifecycle.

3.21 Real Time Passenger Information Systems

Real Time Passenger Information (RTPI) systems provide passengers with live public transport information, including predicted arrival and departure times. These systems are typically delivered through partnerships between highway authorities, public transport operators and other stakeholders.

RTPI systems support public transport reliability and passenger confidence and may be integrated with traffic signal priority systems to improve bus journey times and service punctuality, helping to encourage modal shift and sustainable travel.

As RTPI systems vary between authorities and suppliers, operation and maintenance arrangements should be based on local agreements, manufacturer requirements and relevant industry standards. Authorities should ensure systems are maintained to provide accurate, reliable and timely information to passengers.

3.21.1 Proactive Maintenance

Routine inspections should include:

- Inspection and cleaning of sign displays, facias and shelter-mounted equipment using approved cleaning materials;
- Verification of display performance, including identification of failed or degraded LEDs, pixels or display segments;
- Testing of display functionality using built-in diagnostic facilities or centrally controlled test messages;
- Inspection of sign housings, doors, fixings, locks and mounting arrangements;
- Checking the security, condition, and operation of mechanical components in accordance with manufacturer guidance;
- Recording and reporting defects within the asset management system for corrective action.

Following inspection or maintenance activities, display units should be tested to confirm correct operation and information display.

3.21.2 Relevant Guidance

Authorities should consider relevant industry guidance and interoperability standards, including:

- **RTIGT031** – Centre-to-Centre Traffic Signal Priority Request Protocol https://rtig.org.uk/documents/rtigt031-12;
- Manufacturer-specific operation and maintenance requirements;
- Local authority RTPI and public transport information policies.

Maintenance activities should support the continued reliability, availability and accuracy of passenger information services throughout the asset lifecycle.

3.22 Car Park Management Systems

Car Park Management Systems, also known as **Car Park Guidance (CPG) Systems**, provide real-time parking information to help drivers locate available parking spaces efficiently. By improving parking availability information, these systems support traffic management, network efficiency, road safety, accessibility and effective kerbside management.

CPG systems typically comprise vehicle detection and counting equipment linked to Variable Message Signs (VMS), central management software and communications networks. Many systems are integrated with **UTMC or equivalent network management platforms**, although standalone operation is also possible.

Reliable operation depends upon the accuracy of vehicle detection and occupancy data. Faults affecting detectors, counting equipment, communications or signs can result in incorrect parking information being displayed and should be rectified promptly.

Authorities should operate and maintain CPG systems in accordance with manufacturer guidance, local asset management procedures and relevant smart mobility and parking management strategies.

3.22.1 Proactive Maintenance

Maintenance activities should be undertaken by competent personnel authorised to access the car park and associated equipment. Access arrangements and responsibilities should be defined through agreements between the authority, car park operator and any third-party asset owners.

Site-specific risk assessments should be completed and reviewed before maintenance activities are undertaken.

Routine inspections should include:

- Verification of vehicle counting and occupancy data accuracy;
- Inspection and testing of detection equipment, sensors and communications systems;
- Inspection of cabinets, housings, doors, locks, fixings and electrical equipment;
- Inspection of rising barriers and associated mechanical components, where fitted;
- Checks of carriageway surfaces and vehicle detection loops at entry and exit points;
- Inspection of cabling, containment systems and support structures for damage or deterioration;
- Inspection of associated VMS for visibility, alignment, condition and correct operation;
- Recording and reporting defects within the asset management system.

Operational checks should be undertaken with the system operator to verify that occupancy levels displayed on signs accurately reflect available parking capacity. Where faults have resulted in inaccurate counts, occupancy data should be validated and reset following repair.

3.22.2 Relevant Guidance

Authorities should consider applicable guidance, including:

- **Manual for Smart Streets (MfSS)** - Parking Management Use Case;
- Manufacturer-specific operation and maintenance requirements;
- Local parking, traffic management and smart mobility policies.

Maintenance activities should support the safe, reliable and accurate operation of parking information services throughout the asset lifecycle.

3.23 Traffic Monitoring Equipment

3.23.1 Introduction

Traffic Monitoring Equipment (TME) provides the real-time traffic and network data required to support Intelligent Transport Systems (ITS), UTMC, network management and traveller information services.

Traffic data supports operational decision-making, network performance monitoring, incident management, journey time reporting and service planning. Authorities should manage traffic data in accordance with relevant governance, cybersecurity, privacy and data management requirements.

Common applications include:

- Traffic flow and volume monitoring;
- Vehicle classification;
- Speed measurement;
- Headway analysis;
- Journey time monitoring;
- Traffic image and condition monitoring.

Authorities should refer to the **Manual for Smart Streets (MfSS) – Transport Data Management** guidance and relevant manufacturer documentation when operating and maintaining these systems.

3.23.2 Equipment Types

Common traffic monitoring technologies include:

- **Traffic Counters** – measure traffic volumes using inductive loops, radar, video analytics or other detection technologies;
- **Vehicle Classifiers** – identify vehicle types and support traffic analysis and planning;
- **ANPR Cameras** – measure journey times and network performance by matching vehicle registrations between locations;
- **Over-Height Vehicle Detection Systems** – detect oversized vehicles and trigger warning measures where height restrictions apply.

Many systems integrate with UTMC, network management, VMS and wider smart mobility platforms.

Authorities collecting personal data, including vehicle registration marks, must ensure compliance with applicable data protection legislation and appoint appropriate data management and governance roles.

3.23.3 Proactive Maintenance

Routine inspections should include:

- Verification of detector alignment, operation and data accuracy;
- Cleaning of camera lenses, sensors and optical equipment using approved materials;
- Inspection of poles, cabinets, fixings and mounting arrangements;
- Inspection of cables, connectors and power supplies;
- Checks of carriageway loops, sensors and associated road surfaces where fitted;
- Removal or reporting of graffiti, fly-posting and other vandalism;
- Identification of vegetation or obstructions affecting performance or visibility;
- Recording and reporting defects within the asset management system.

3.23.4 Operational Testing

Operational checks should confirm that equipment is collecting and reporting accurate data.

Typical checks include:

- **Counters, classifiers and speed sites** – verification of traffic counts, vehicle classification, speed measurement, communications and data reporting;
- **Over-height detection systems** – confirmation that vehicle detection and associated warning systems operate correctly;
- **ANPR systems** – verification of camera alignment, image quality, number plate recognition accuracy, communications and journey time reporting.

Where systems are connected to a UTMC, RMS, or equivalent platform, communications and data integrity should also be verified.

3.23.5 Health and Safety Considerations

Many monitoring systems, particularly ANPR and over-height detection equipment, are mounted on tall poles or structures. Safe access requirements, working at height risks and traffic management requirements should be considered during design, installation and maintenance.

Authorities should undertake site-specific risk assessments and ensure appropriate traffic management, lane closures and safe systems of work are in place before maintenance activities are undertaken.

3.23.6 Relevant Guidance

- **Manual for Smart Streets (MfSS)** – Transport Data Management Use Case.
- Manufacturer-specific operation and maintenance requirements.
- Applicable data protection, cybersecurity, and information governance requirements.

Maintenance activities should ensure traffic monitoring systems remain safe, reliable, accurate, and capable of supporting effective network management throughout their operational life.

3.24 Automatic Rising Bollards

Automatic rising bollards may be used to control vehicle access, support the operation or enforcement of Traffic Regulation Orders (TROs), and manage access to restricted areas, pedestrian zones, bus gates and security-sensitive locations. Access may be controlled through transponders, ANPR, inductive loops or other appropriate detection and access-control systems.

Automatic rising bollards are safety-critical moving systems and, where used for hostile vehicle mitigation (HVM), may also be security-critical. Authorities should ensure that systems are designed, installed, commissioned, operated and maintained through a documented, risk-based approach, taking account of highway safety, accessibility, security, reliability, resilience and whole-life asset management.

Particular consideration should be given to vehicle and vulnerable road-user safety, detection and interlocking arrangements, emergency-service access, drainage, communications, power failure, maintenance access and safe operation following equipment or system failure.

The appropriate safe state should be established through the site-specific risk assessment and operational requirements. For access-restriction systems, TOPAS 2510B requires bollards to retract when mains power is unavailable; different arrangements apply to HVM systems, where security requirements may require the bollard to remain in its last position or operate from an alternative power source.

Authorities should identify the legislation, standards, specifications and manufacturer requirements applicable to each installation. These may include **TOPAS 2510B – Performance Specification for Rising Bollards Control and Indicator Systems**, TOPAS 0600, BS EN ISO 13849-1, BS EN 60204-1, BS EN 12453, BS EN 12445 and BS 7671, together with applicable product conformity, highway, traffic-signing, health and safety, data-protection and cyber-security requirements. HVM installations should additionally consider an appropriate recognised impact-test standard and specialist security requirements.

3.24.1 Proactive Maintenance

Maintenance frequencies should be determined through a risk-based approach considering asset criticality, operating environment, usage, safety and security function, manufacturer recommendations, fault history and the consequences of failure.

Systems subject to high operating cycles, harsh environments or significant safety or security consequences may require enhanced inspection and maintenance. Only competent and authorised personnel should undertake maintenance or safety-related work.

3.24.2 Routine Maintenance Activities

Inspections should include:

- Verification of bollard operation, control systems and safety functions;
- Testing of warning lights, indicators, interlocks and emergency controls;
- Inspection of vehicle detection equipment, including loops, ANPR systems and transponders;
- Inspection of associated traffic signs, road markings and warning devices;
- Inspection of cabinets, housings, poles, fixings and electrical equipment;
- Inspection of carriageway surfaces and vehicle detection loops, where fitted;
- Cleaning and inspection of bollard chambers, drainage systems and moving components;
- Inspection and lubrication of mechanical components in accordance with manufacturer guidance;
- Functional testing of normal, emergency and fault-recovery arrangements;
- Inspection following a collision, impact or other event that may have affected safe operation;
- Recording of inspections, tests, faults, maintenance and configuration changes within the authority's asset-management system.

3.24.3 Health and Safety Considerations

Maintenance activities should be supported by suitable and sufficient risk assessments and safe systems of work. Particular consideration should be given to electrical isolation, moving machinery, stored energy, lifting operations, underground chambers or pits, water ingress and inadvertent bollard activation.

Traffic management, lane closures or diversions may be required for inspection, testing and maintenance. Safe future access should therefore be considered during design and subsequent modification of the installation.

Following a collision, unexplained activation or safety-related incident, the system should be inspected and made safe by a competent person before being returned to normal service.

3.24.4 Relevant Guidance

- **TOPAS 2510B** – Performance Specification for Rising Bollard Control and Indicator Systems (https://topasgroup.org.uk/media/2510B-final-180423.pdf)
- Manufacturer-specific operation and maintenance requirements;
- Relevant TROs, highway authority procedures and health and safety legislation.

Authorities should confirm the current version, status and applicability of standards and specifications at the time of design, procurement, installation or modification.

Maintenance activities should ensure that rising bollard systems remain safe, reliable, and available to support access control and traffic management objectives throughout the asset lifecycle.

3.25 CCTV Cameras

CCTV cameras are widely used to support network management, traffic monitoring, incident detection, and operational decision-making. Due to their specialist nature, CCTV systems are typically maintained under dedicated maintenance contracts and service level agreements.

Authorities should ensure CCTV systems remain fully operational, with faults prioritised according to their impact on network monitoring and service delivery.

Urgent faults typically include:

- Loss of camera images;
- Significant image quality degradation;
- Loss of camera control functions;
- Damage to outstation equipment or supporting infrastructure.

Following repairs, contractors should confirm satisfactory operation with the control centre or system operator, including verification of camera functions such as pan, tilt, zoom, focus, and communications.

3.25.1 Proactive Maintenance

Preventative maintenance should be undertaken in accordance with manufacturer guidance and local maintenance procedures. Inspections should cover:

- **Instation equipment;**
- **Outstation equipment;**
- **Communications and transmission systems.**

Routine maintenance activities should include:

- Cleaning of camera lenses, housings, and screens using approved materials;
- Inspection and replacement of wipers, washers, or other environmental protection devices where fitted;
- Verification of camera alignment, focus, image quality, and field of view;
- Testing of pan, tilt, zoom, preset positions, and other operational features;
- Inspection of visibility and identification of obstructions, including vegetation requiring removal;
- Inspection of poles, mounting brackets, winch systems, counterweight mechanisms, and lifting equipment where fitted;
- Inspection of cabinets, doors, locks, fixings, seals, and electrical equipment;
- Recording and reporting of defects within the asset management system.

Foliage or other obstructions affecting camera performance should be identified and appropriate remedial action arranged.

3.25.2 Health and Safety Considerations

CCTV cameras are frequently mounted on tall poles, masts, or other structures to maximise network visibility. Maintenance activities may therefore involve working at height adjacent to live traffic.

Authorities should undertake site-specific risk assessments and ensure appropriate traffic management, lane closures, permits, and safe systems of work are in place before maintenance activities commence.

Where lowering mechanisms, winches, or counterweight systems are installed, these should be inspected and maintained in accordance with manufacturer requirements.

3.25.3 Asset Condition and Infrastructure

Camera housings, poles, cabinets, and associated structures should be inspected for corrosion, deterioration, vandalism, security issues, and other defects that may affect operational performance or asset life.

Any identified defects should be repaired or scheduled for remedial action in accordance with local maintenance procedures and asset management priorities.

3.25.4 Relevant Guidance

- Manufacturer-specific operation and maintenance requirements;
- Applicable data protection, cybersecurity, and information governance requirements;
- Local authority CCTV, network management, and asset management policies.

Maintenance activities should ensure CCTV systems remain safe, reliable, and capable of supporting effective network monitoring and incident management throughout their operational life.

3.26 Electric Vehicle Charging Infrastructure

Electric Vehicle Charging Infrastructure (EVCI) forms an increasingly important part of the highway and transport asset portfolio, comprising charging equipment, electrical connections, communications systems, software platforms and associated roadside technology.

EVCI may be delivered through a range of ownership and operating models, including authority-owned, concession, lease and third-party arrangements. Asset management responsibilities will therefore vary and should be clearly defined between the authority, asset owner and operator.

Authorities should apply lifecycle asset management principles covering planning, procurement, commissioning, adoption and handover, operation, maintenance, performance monitoring, renewal, replacement and decommissioning. Utilisation data, including charging sessions, energy consumption, availability and demand trends, should inform maintenance, investment and network development decisions.

MRT does not replace existing technical or physical infrastructure guidance for EV charging, including cross-pavement solutions. Its focus is the consistent lifecycle management of roadside technology assets.

3.26.1 Accessibility and Inclusive Design of EV Charging Infrastructure

The design and installation of Electric Vehicle Charging Infrastructure (EVCI) should ensure that charging facilities are accessible, inclusive, and convenient for all users, including disabled people and those with reduced mobility. Authorities and designers should have due regard to their duties under the **Equality Act 2010** and adopt the principles of inclusive design from the earliest stages of scheme development.

Designers should refer to the **Motability Foundation and Designability Accessible EV Charging Guidance** and **BSI PAS 1899 – Electric Vehicles – Accessible Charging Specification**, which have been developed using extensive user research and feedback from disabled motorists. These documents provide practical guidance on creating charging facilities that are accessible, safe, and easy to use.

Accessibility considerations should be integrated alongside other highway design requirements to ensure charging infrastructure does not create barriers for pedestrians, wheelchair users, visually impaired people, or other vulnerable road users.

3.26.2 Key Design Considerations

When selecting locations and designing EV charging installations, designers should consider:

- Maintaining sufficient unobstructed footway widths to accommodate pedestrians, wheelchair users, mobility scooter users, and pushchairs;
- Positioning charging units and feeder pillars to avoid obstructing pedestrian routes and desire lines;
- Minimising the risk of charging cables crossing footways and creating trip hazards;
- Providing level, accessible routes between parking bays, charging equipment, and nearby facilities;
- Ensuring dropped kerbs and suitable crossing points are available where required;
- Locating equipment to minimise collision risks from vehicles and providing protection where appropriate;
- Avoiding obstruction of traffic signs, sightlines, pedestrian visibility splays, and other highway assets;
- Considering the potential impact of advertising screens, displays, or illuminated equipment on driver distraction and road safety;
- Providing suitable space around charging units to enable independent use by disabled motorists;
- Ensuring controls, displays, connectors, and payment systems are accessible to users with a range of physical and sensory impairments.

3.26.3 Common Issues Identified During EV Charger Audits

Audits of EV charging installations have identified several recurring design issues:

- Insufficient footway width following installation of charging equipment or feeder pillars;
- Charging cable arrangements that create hazards for pedestrians and wheelchair users;
- Charging units installed within the carriageway without adequate vehicle protection;
- Advertising displays that may create unnecessary driver distraction;
- Equipment obstructing traffic signs or reducing visibility;
- Lack of dropped kerb access or accessible routes to charging facilities and nearby amenities.

Designers should seek to eliminate these issues at the planning and design stage through appropriate site selection, layout design, and stakeholder engagement.

3.26.4 Relevant Guidance

- **BSI PAS 1899 – Electric Vehicles: Accessible Charging Specification;**
- **Motability Foundation and Designability Accessible EV Charging Guidance;**
- **Equality Act 2010;**
- **Inclusive Mobility** (DfT);
- **Manual for Streets** and local highway design guidance.

Adopting accessible design principles from the outset will help ensure EV charging infrastructure is safe, inclusive, and available to all users, while supporting wider transport decarbonisation and accessibility objectives.

3.26.5 Asset Management Principles

Authorities should manage EVCI as a whole-life asset and maintain accurate asset records, including:

- Asset location and ownership;
- Charger type and power rating;
- Installation and commissioning dates;
- Communications and monitoring arrangements;
- Maintenance responsibilities and service agreements;
- Asset condition and performance data.

EVCI should be incorporated into existing asset management systems, inspection regimes, and maintenance reporting processes.

Given the rapid pace of technological change, authorities should consider future-proofing, interoperability, scalability, cybersecurity, and whole-life costs during design and procurement. Lifecycle planning should account for installation, operation, maintenance, software support, communications services, refurbishment, and eventual replacement.

3.26.6 Operation and Maintenance

Authorities should adopt both proactive and reactive maintenance strategies to maximise charger availability, reliability, and user confidence.

Where practicable, charging infrastructure should incorporate remote monitoring and fault management systems to support:

- Fault detection and diagnostics;
- Performance monitoring;
- Asset condition assessment;
- Maintenance scheduling;
- Service reporting;

Key performance indicators may include:

- Charger availability;
- Reliability and uptime;
- Fault response and repair times;
- Asset condition and use.

Maintenance activities should be undertaken by competent persons and in accordance with manufacturer requirements, electrical safety legislation, and relevant industry standards.

3.26.7 Proactive Maintenance

Routine inspections should include:

- Verification of charger operation and communications;
- Inspection of electrical connections, enclosures, and protective devices;
- Inspection of charging cables, connectors, and user interfaces;
- Functional testing of payment, authentication, and access systems where fitted;
- Inspection of signage, road markings, bay markings, and associated street furniture;
- Verification of remote monitoring and fault reporting systems;
- Inspection for vandalism, damage, corrosion, or environmental deterioration;
- Recording and reporting of defects within the asset management system.

3.26.8 Safety and Compliance

Authorities should ensure EVCI is maintained in accordance with:

- Electricity at Work Regulations;
- BS 7671 (Requirements for Electrical Installations);
- Relevant EV charging infrastructure standards and guidance;
- Manufacturer operation and maintenance requirements;
- Applicable cybersecurity and data protection requirements.

Appropriate procedures should be in place to manage electrical safety, emergency isolation, inspection regimes, and incident reporting.

3.26.9 Asset Lifecycle and Renewal

Authorities should regularly review asset condition, performance, use, and technological suitability to support investment planning and timely renewal.

Replacement programmes should consider advances in charging technology, user demand, accessibility requirements, grid capacity, and future transport network needs.

Effective lifecycle management will help ensure EVCI remains safe, reliable, accessible, and fit for purpose throughout its operational life.

Key Components of EV Infrastructure

Charging Points	Ranging from slower overnight chargers for homes/streets to rapid/ultra-rapid chargers for quick top-ups on motorways and in public areas, often with different connector types (Type 2, CCS).
Power Grid	The electrical network that supplies power to charging stations, requiring upgrades to handle increased demand.
Software & Networks	Digital platforms for managing charging, payments, and network connectivity.
Support Structures	Wiring, posts, and enabling infrastructure for parking spaces, including retrofitting lamp posts.
UK Initiatives & Investments	
Government Funding	Schemes like the Local EV Infrastructure (LEVI) fund provide grants for on-street charging and work with industry to overcome installation barriers.
UK Infrastructure Bank	Supports funds like the Charging Infrastructure Investment Fund (CIIF) to scale public networks.
Strategic Network Growth	Focus on rapid and ultra-rapid chargers near major roads, with plans to exceed current capacity ahead of demand.
Types of Charging	
Standard/Slow	For home and residential street charging (e.g., lamp posts).
Rapid	Can charge a vehicle in 20-30 minutes, common on major roads.
Ultra-Rapid	Even faster charging, often found at motorway service areas.
Importance	
Supports EV Adoption	Essential for consumer confidence as the number of EVs grows.
Drives Sustainability	Enables the transition to zero-emission transport, reducing air pollution.
Economic Growth	Attracts investment and creates employment in the EV sector.

3.26.10 Signposting to Existing Standards and Guidance

Where possible the MRT avoids duplicating technical requirements that are already addressed within established industry guidance by signposting to relevant documents and standards that support the design, installation, operation and maintenance of EVCI.

Where EVCI incorporates associated technologies such as battery energy storage systems, solar generation, wireless charging systems or smart energy management platforms, authorities should also refer to the relevant specialist standards and guidance applicable to those technologies.

Further EV Charging Infrastructure information can be found at:

Source	Title	Link
MfSS	**Use cases**	https://mfss.ttf.uk.net/manual-for-smart-streets/
BSI	**BS 7671 Requirements for Electrical Installations (IET Wiring Regulations)**	https://electrical.theiet.org/bs-7671-18th-edition-wiring-regulations/
Cenex	**Technical Schedules**	https://www.cenex.co.uk
DfT	**Electric Vehicle Infrastructure Strategy**	https://www.gov.uk/government/publications/uk-electric-vehicle-infrastructure-strategy
IET	**Guide to EV Charging Infrastructure for Local Authorities**	https://electrical.theiet.org/guidance-and-codes-of-practice/publications-by-category/electric-vehicles/guide-to-electric-vehicle-charging-infrastructure-for-local-authorities/
Nevis	**National EV Insight & Support – delivered by Cenex**	https://nevis.cenex.co.uk/wales
OZEV	**OZEV guidance and grant requirements**	https://www.gov.uk/guidance/electric-vehicle-chargepoint-grants
DfT	**Public Charge Point Regulations**	https://www.gov.uk/government/publications/the-public-charge-point-regulations-2023-guidance/public-charge-point-regulations-2023-guidance
BSI	**PAS 1899 Accessible Charging Specification**	https://www.bsigroup.com/en-GB/insights-and-media/insights/brochures/pas-1899-electric-vehicles-accessible-charging-specification/
ZEVI	**Universal Design Guidelines for EV Charging Infrastructure**	https://www.zevi.ie/sites/default/files/2024-10/UDG-Full-Doc-English.pdf

Authorities should also refer to the relevant IEC, ISO and SAE standards applicable to charging systems and communications protocols and national guidance relating to cybersecurity, smart charging and vehicle-to-grid technologies.

EVCI is recognised within the MRT as a distinct electronic transport asset and focusses on establishing asset management expectations rather than reproducing technical installation requirements already covered elsewhere.

By incorporating EVCI within existing asset management frameworks, authorities will be better positioned to manage asset performance, reliability, lifecycle costs and service delivery outcomes. This approach is consistent with the existing objectives of the Code and supports the long-term operation of a safe, reliable and sustainable transport network

Section 4
Maintenance Contracts



4.1 Introduction

Electronic traffic control and ITS assets require ongoing maintenance throughout their operational life to ensure safety, reliability and network performance. Maintenance activities may range from minor component replacement to major asset refurbishment or renewal.

Maintenance contracts should clearly define the requirements for both **reactive maintenance** (fault response and repair) and **planned preventative maintenance (PPM)**. The scope, performance standards, and service levels should align with the authority's asset management strategy and operational objectives.

Authorities should seek to achieve **best value** through an appropriate balance of cost, quality, performance, resilience, and whole-life asset management outcomes. Procurement should be undertaken in accordance with the **Procurement Act 2023**, the authority's procurement procedures, and relevant industry standards.

4.2 Contract Strategy

When developing a maintenance contract, authorities should consider:

- **Scope** – whether the contract covers maintenance only or includes installation, renewal, inspections, communications equipment, software support, and ancillary assets;
- **Contract Value** – ensuring the size of the contract attracts suitably qualified and experienced suppliers while delivering value for money;
- **Contract Duration** – balancing the benefits of longer-term arrangements, including improved asset knowledge and investment by the contractor, against the need to maintain competitive market testing and performance accountability;
- **Asset Knowledge and Continuity** – recognising that familiarity with local assets, systems, stakeholders, and operational requirements can improve service delivery and reduce response times.
- **TUPE Requirements** – allowing sufficient time and resources to manage any Transfer of Undertakings (Protection of Employment) obligations where applicable;
- **Collaborative Procurement** – considering joint contracts with neighbouring authorities or regional partnerships to achieve economies of scale, improve market attractiveness, and reduce procurement costs;
- **Performance Management** – establishing clear Key Performance Indicators (KPIs), service levels, reporting requirements, and quality measures to monitor contract delivery and demonstrate value;
- **Client Resources** – ensuring adequate authority resources are available to manage, monitor, and audit contract performance throughout the contract term;



Photo: Warwickshire County Council

4.3 Performance and Contract Management

Maintenance contracts should include:

- Clearly defined fault response and repair times;
- Planned maintenance requirements and inspection frequencies;
- Asset data and reporting requirements;
- Competency, accreditation, and training requirements;
- Health, safety, environmental, and quality management requirements;
- Cybersecurity and software support responsibilities, where applicable;
- Performance monitoring arrangements and continuous improvement provisions.

Performance measures should encourage high-quality service delivery, asset reliability, and customer outcomes rather than focusing solely on financial incentives or penalties.

4.4 Good Practice

Authorities should adopt a contract model that:

- Supports effective lifecycle asset management;
- Promotes collaboration between the authority and contractor;
- Encourages innovation and continuous improvement;
- Provides resilience and business continuity;
- Delivers safe, reliable, and efficient operation of roadside technology assets.

Well-structured maintenance contracts are fundamental to achieving long-term asset performance, regulatory compliance, and value for money across the highway technology portfolio.



4.5 Public Sector Procurement and Contract Management

The procurement of maintenance, installation, and support services for traffic control and ITS assets should be undertaken in accordance with current public procurement legislation and the authority's governance, financial and asset management requirements.

Authorities should adopt a procurement strategy that delivers **best value**, promotes competition, supports innovation, and secures high-quality service delivery throughout the asset lifecycle. Procurement decisions should consider whole-life costs, asset performance, resilience, sustainability, and operational outcomes rather than initial purchase price alone.

4.5.1 Procurement Legislation

The **Procurement Act 2023** came into force on **24 February 2025**, replacing the Public Contracts Regulations 2015 for new procurements in England, Wales, and Northern Ireland.

The Act introduces a simplified and more transparent procurement regime, requiring contracting authorities to publish relevant procurement notices and contract information through the **Central Digital Platform (CDP)**, accessed via the Find a Tender Service.

Procurements commenced under the Public Contracts Regulations 2015 continue to be managed under that legislation until the relevant contract, framework, or dynamic purchasing arrangement expires.

The UK remains a signatory to the **World Trade Organisation Government Procurement Agreement (GPA)**, ensuring that public procurement is undertaken in accordance with the principles of transparency, non-discrimination, integrity, and fair competition.

4.5.2 Procurement Routes

Authorities may procure roadside technology services through a range of procurement routes, including:

- Open competitive procurements;
- Framework agreements;
- Dynamic Markets established under the Procurement Act 2023;
- Collaborative or joint procurements with other authorities;
- Centralised procurement authorities and commercial frameworks.

The selected procurement route should reflect the value, complexity, risk, and operational requirements of the service being procured.

4.5.3 Framework Agreements

Framework agreements are widely used for the procurement of roadside technology products and services. They can reduce procurement timescales, minimise administration costs, and provide access to pre-qualified suppliers.

Frameworks may be established for the sole use of an authority or made available to multiple organisations through a centralised procurement authority.

Authorities should ensure that any call-off arrangements comply with the framework rules and that any contractual modifications remain within the scope of the original procurement.

4.5.4 Government Commercial Frameworks

Authorities should consider the use of relevant Government Commercial and public sector framework agreements where appropriate.

At the time of publication, the principal transport technology framework is:

4.5.5 RM6347 – Transport Technology Open Framework

This framework provides access to products, services, consultancy, software, installation, maintenance, communications, data management, and broader transport technology solutions. Authorities should verify current framework arrangements and supplier information before commencing procurement activity.

4.6 Contract Types and Delivery Models

The delivery model adopted should align with the authority's objectives, risk profile, and asset management strategy. Common approaches include:

4.6.1 Schedule of Rates Contracts

Contracts based on agreed rates for maintenance activities, repairs, renewals, and equipment supply. These are commonly used where work volumes vary and are difficult to predict accurately.

4.6.2 Performance-Based Contracts

Contracts focused on achieving defined service outcomes and Key Performance Indicators (KPIs), such as asset availability, fault response times, and network performance. Payment mechanisms may be linked to achievement of agreed performance standards.

4.6.3 Collaborative or Partnership Contracts

Longer-term arrangements where authorities and suppliers work together to deliver service improvements, innovation, efficiency savings, and whole-life asset management benefits. These contracts typically include shared objectives, performance measures, and continuous improvement initiatives.

4.6.4 Framework Call-Off Contracts

Individual contracts awarded under an existing framework agreement through direct award or further competition, depending on the framework requirements.

4.7 Contract Documentation

Authorities should ensure that contract documentation clearly defines:

- Scope of services;
- Asset responsibilities;
- Inspection and maintenance requirements;
- Service levels and response times;
- KPIs and reporting requirements;
- Health, safety, environmental, and quality requirements;
- Cybersecurity and software support obligations;
- Asset data management requirements;
- Change management and continuous improvement arrangements.

Where appropriate, authorities should consider the use of recognised standard forms of contract, including:

- Government Standard Contracts;
- NEC Term Service Contracts;
- JCT Contracts;
- Framework-specific call-off agreements.

4.8 Performance Monitoring and Contract Management

Effective contract management is critical to achieving value for money and maintaining asset performance.

The **Procurement Act 2023** requires contracts valued at over **£5 million** to include at least three published KPIs. Contracting authorities must assess and publish supplier performance against these measures at least annually and at contract completion.

Authorities should ensure that sufficient suitably qualified and experienced staff are available to:

- Monitor contractor performance;
- Audit maintenance activities;
- Validate KPI reporting;
- Review asset condition and service outcomes;
- Manage contract risks and change processes.

Authorities should also follow the principles set out within the Cabinet Office Contract Management Playbook.

4.9 Asset Information and Contract Scope

Accurate and up-to-date asset inventories are fundamental to successful procurement and contract management.

Prior to procurement, authorities should ensure that:

- Asset registers are complete and maintained;
- Existing defects and operational issues are understood;
- Asset ownership and maintenance responsibilities are defined;
- Performance expectations are clearly specified.

The contract should clearly define responsibility for materials, components, software, communications services, and replacement equipment to minimise ambiguity and transfer of risk disputes.

4.10 Service Credits and Performance Adjustments

Contracts may include service credits or other performance adjustment mechanisms where suppliers fail to meet agreed service levels or KPI targets.

Any deduction mechanism should:

- Be clearly defined within the contract;
- Reflect the impact of service failure;
- Be proportionate and legally enforceable;
- Encourage timely corrective action and continuous improvement.

The objective should be to drive improved performance and service delivery rather than impose punitive financial penalties.

4.11 Best Practice

Authorities should adopt procurement and contract management arrangements that:

- Support whole-life asset management;
- Deliver best value and transparency;
- Promote innovation and continuous improvement;
- Ensure compliance with current legislation;
- Maintain safe, reliable, and resilient roadside technology services.

Effective procurement and contract management are essential to achieving long-term operational performance, regulatory compliance, and sustainable management of highway technology assets.

4.12 Electricity Procurement and Unmetered Supplies

The provision of an electrical supply is a critical element of the design and operation of roadside technology assets. At the design stage, authorities should engage with the relevant **Distribution Network Operator (DNO)** at an early stage to determine supply requirements, connection arrangements, programme implications, and associated costs.

Applications for new supplies should include details of the proposed equipment location, feeder pillar location, anticipated connection date, electrical loading, and required fuse ratings. Electrical designs should ensure appropriate discrimination, protection, and compliance with current electrical standards and DNO requirements.

Additional information may be required during the application process, including operating hours, equipment type, maximum demand, and earthing arrangements.



Photo: NAL

4.12.1 Unmetered Supplies

Many roadside technology assets, including traffic signals, pedestrian crossings, illuminated signs, and other low-voltage highway equipment, are supplied through Unmetered Supplies (UMS) arrangements.

An Unmetered Supply is an electricity supply connected to the distribution network without a conventional electricity meter. Consumption is calculated using approved inventories and settlement procedures managed through the Balancing and Settlement Code (BSC).

Authorities should ensure that all unmetered assets are accurately recorded and maintained within their inventory management systems.

Two principal settlement arrangements are available:

- **Non-Half-Hourly (NHH)** – consumption is based on an Estimated Annual Consumption (EAC) calculated from inventory data and approved operating regimes;
- **Half-Hourly (HH)** – consumption is determined using an Equivalent Meter and recorded through half-hourly settlement arrangements.

Authorities should seek specialist advice from their electricity supplier, Meter Administrator, and Unmetered Supplies Operator (UMSO) when determining the most appropriate trading arrangement.

4.12.2 Unmetered Supplies Certificates

Accurate asset inventories are fundamental to electricity procurement and settlement.

Authorities should maintain inventories that include approved equipment types, charge codes, switching regimes, operating hours, and asset locations in accordance with **BSCP520 – Unmetered Supplies Registered in SMRS.**

Following validation of the inventory, the DNO or UMSO will issue an **Unmetered Supplies Certificate (UMSC).** This certificate should be made available during the procurement of electricity supply contracts and updated whenever significant inventory changes occur.

As a general principle, equipment with predictable electrical loads may qualify for inclusion within an unmetered supplies arrangement, subject to the requirements of BSCP520 and approval by the UMSO.

Where larger electrical loads are proposed, authorities should consult the DNO at an early stage to determine whether a metered supply arrangement is required.

4.12.3 Key Agreements

Authorities typically require the following agreements:

- **Connection Agreement** – setting out the terms under which equipment is connected to the DNO network;
- **Meter Administrator Agreement** – where required for management of unmetered supply arrangements and associated equipment;
- **Electricity Supply Agreement** – covering the purchase of electrical energy from a licensed supplier;
- **Metering Point Administration Number (MPAN) Registration** – registration of the supply for settlement and billing purposes.

Authorities should ensure these arrangements are maintained and reviewed throughout the life of the asset.

4.12.4 Asset Management and Inventory Control

Accurate electrical inventories are essential for:

- Energy procurement and billing;
- Carbon reporting;
- Asset management;
- Regulatory compliance;
- Financial forecasting.

Authorities should implement robust processes to ensure that additions, removals, upgrades, and energy-related changes are promptly reflected within asset inventories and Unmetered Supplies Certificates.

4.12.5 Renewable and Alternative Energy Sources

Where renewable or alternative energy sources are proposed, such as solar or wind-powered systems, authorities should undertake a whole-life assessment of operational reliability, maintenance requirements, and asset criticality.

Particular consideration should be given to:

- Asset resilience during periods of reduced energy generation;
- Battery performance and replacement cycles;
- Maintenance requirements for renewable energy equipment;
- End-of-life replacement costs;
- Operational risks associated with loss of power.

Safety-critical equipment should only use alternative energy sources where the authority is satisfied that the power supply can maintain the required level of operational availability and reliability.

4.12.6 Relevant Guidance

Authorities should comply with:

- **Electricity at Work Regulations 1989;**
- **BS 7671 – Requirements for Electrical Installations (IET Wiring Regulations);**
- **Balancing and Settlement Code (BSC);**
- **BSCP520 – Unmetered Supplies Registered in SMRS;**
- DNO, UMSO, and electricity supplier requirements;
- Local authority electrical and asset management procedures.

Effective electricity procurement, inventory management, and power supply design are essential to ensuring the safe, reliable, and cost-effective operation of roadside technology assets throughout their lifecycle.

4.13 Telecommunications Procurement

4.13.1 Introduction

Remote access to an asset and continual monitoring of the equipment are standard requirements as part of the design and installation of roadside technology equipment. These requirements should be achieved through the provision of a communications service to the equipment, of a type to be agreed by the authority during the design stage.

Each communication type is provided by a CSP. The authority will need to agree trading terms and conditions in advance of any connection being made, with the relevant CSP.

Types of communication currently available for use with electronic traffic equipment mainly fall into the following categories:

- Broadband Internet Protocol Addressed Circuits: A broadband service provided over cabled telephonic technology. The service is a continuous connection, and speeds of the service can vary depending on the CSP and the service paid for. This type of communication allows a large amount of data to be sent and retrieved from the asset;
- Fibre Optic Cable: A communications service provided by the use of fibre optic cables, which can be used to transmit large volumes of data at high speeds. This service is provided by specialist CSPs and will require additional equipment to be installed at the asset;
- Wireless A communications service provided without wires, using technology initially developed for computer networks. This service is provided by specialist CSPs and will require additional equipment to be installed at the asset.

Appendix D Provides a detailed overview of Telecommunications procurement.

4.13.2 Trading Arrangements

Local trading arrangements should be agreed between the authority and supplier before any communication services are purchased or installed. These agreements should cover installation timescales, fault response, the service types included, the scope of works for installation, and liability.

In most cases, trading arrangements could already exist between authorities and suppliers for other communication services provided to the authorities. Wherever possible, these should be used for the provision of communication services for roadside technology equipment.

For further information on CSPs available and current regulations, please refer to the communication regulator's website, https://www.ofcom.org.uk.

Appendix

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Appendix A: Key Principles

The following recommendations are made within the document.

No.	Key Principle
1	Authorities that adopt policies, procedures or standards that differ from those recommended in this document must clearly identify and document the variations, including the reasons for them, and obtain appropriate approval. Once established, procedures for managing maintenance requirements should be reviewed regularly to ensure they remain fit for purpose and comply with current regulations and guidance.
2	Authorities should undertake a comprehensive review of current practices and identify any differences from the key principles in Management of Roadside Technology. Any gaps should be addressed through a formal Implementation Plan, managed as a structured project with agreed milestones, resources and budgets.
3	All parties involved in delivering the service should seek ways to improve it to meet customers' needs. New equipment, processes and strategies should have identifiable, tangible benefits. Cost should not be the only consideration, as other qualitative factors also matter.
4	Detailed asset and data management systems must be put in place and maintained, including data security measures.
5	Local authorities should future-proof roadside technology, systems and processes as far as practicable. This means selecting **current, supported and non-obsolete technologies** that can be readily maintained, updated and upgraded across both hardware and software. Procurement should also consider **long-term support, compatibility, upgrade paths and anticipated obsolescence,** helping to maximise asset life, whole-life value and the ability to adapt to future operational and technological requirements.
6	Where possible, authorities should support the use of recycling and re-use of equipment within their maintenance regime.
7	Local authorities should make low-energy equipment the norm for new installations and consider whole-life energy consumption alongside installation, operation and maintenance costs. Where practicable, older high-energy equipment should be upgraded or retrofitted with lower-energy technology. Where legacy or obsolete equipment cannot be economically or technically retrofitted, authorities should consider planned modernisation or replacement, taking account of asset condition, obsolescence, available funding and whole-life value.
8	Authorities should ensure that suitably trained staff are in place to undertake the management of maintenance of roadside technology and its associated equipment.
9	Performance indicators should be used to measure authority and contractor effectiveness in delivering the service and to provide a baseline from which improvements can be measured.
10	Authorities should provide financial plans for maintenance and operation of roadside technology that detail their priorities as well as clear direction on how the operations will be managed in the short, medium and long term.
11	Authorities should ensure that adequate data management systems are in place to process and manage faults.
12	Maintaining authorities should, where appropriate, enable the automated transfer of **selected fault data** from UTC, RMS and other network management platforms into an appropriate FMS. Authorities should determine which faults are automatically reported based on **risk, operational requirements and local maintenance arrangements.** Fault notifications should contain sufficient information to support effective diagnosis and repair. Data integration between traffic management, maintenance and asset management systems should also be encouraged to improve operational efficiency and support evidence-based asset management.
13	Designers shall adopt a whole-life asset management approach, taking account of installation, operation, maintenance, renewal and decommissioning requirements during the design stage. Design decisions should seek to minimise future maintenance interventions, reduce whole-life costs, improve asset reliability and enhance the safety of both operatives and network users throughout the asset lifecycle.
14	Authorities should publish an annual assessment of performance against their Service Policy Statement, asset management objectives and applicable national and local performance indicators. The report should identify achievements, areas for improvement, planned actions and progress towards delivering a safe, reliable, sustainable and efficient traffic control service.
15	Authorities should ensure that maintenance contractors have appropriate procedures, resources, competencies and management arrangements in place to deliver an effective maintenance service in accordance with contractual requirements and agreed service levels.
16	Proactive maintenance should be regarded as a key element of effective asset management, helping to prevent asset failures, improve reliability, maintain safety and support the long-term performance of roadside technology and associated systems.
17	Authorities should prioritise the replacement of ageing halogen signal technology with LED alternatives, where technically and economically practicable, to improve reliability, reduce energy and maintenance costs, and support long-term asset sustainability. Authorities should assess whether retrofit solutions are appropriate or whether full modernisation is required, taking account of the condition and compatibility of controllers, cabling and associated equipment, together with obsolete or no longer prescribed signal arrangements and physical layouts that may require upgrading to meet current design requirements, including Traffic Signs Manual Chapter 6. This assessment should inform a proportionate, risk-based and whole-life approach to investment and renewal.

Appendix B: Glossary of Terms

Term	Description
AI	Artificial Intelligence
AQM	Air Quality Management
ANPR	Automatic Number Plate Recognition
CCTV	Closed Circuit Television
CDM	Construction (Design and Management) Regulations
CPG	Car Park Guidance
CSP	Communication Service Provider
DFM	Detector Fault Monitoring
DCIS	Digital Controller Interface Standard
DMRB	Design Manual for Roads and Bridges
DNO	Distribution Network Operator (i.e. power suppliers etc.)
EAC	Estimated Annual Consumption
ELV	Extra Low Voltage
EM	Equivalent Meter
EMS	Electronic Message Sign
EV	Electric Vehicle
EVCI	Electric Vehicle Charging Infrastructure
FMS	Fault Management System
GIS	Geographic Information System
GPS	Global Positioning System
IEEE	Institution of Electrical and Electronics Engineers
IG	Interest Group (TTF)
IP	Internet Protocol
IT	Information Technology
IoT	Internet of Things
ITS	Intelligent Transport Systems
IVMS	In Vehicle Message Signs
KPI	Key Performance Indicator
LED	Light Emitting Diode
LEZ	Low Emission Zone

Term	Description
LPI	Local Performance Indicator
LTN	Local Transport Note
MaaS	Mobility as a Service
MfSS	Manual for Smart Streets
MPRS	Metering Point Registration Service
MVD	Microwave Vehicle Detector
NI	National Indicators
NICEIC	National Inspection Council for Electrical Installation Contracting
NRSWA	New Roads and Street Works Act
OJEU	Official Journal of the European Union
PI	Performance Indicator
RMS	Remote Monitoring System
RTC	Road Traffic Collision
RTIG	Real Time Information Group
RTPI	Real Time Passenger Information
SIM	Subscriber Identity Module
TAL	Traffic Advisory Leaflet
TOPAS	Traffic Open Products and Specifications
TRO	Traffic Regulation Order
TTF	Transport Technology Forum
D-TRO	Digital Traffic Regulation Order
TSRGD	Traffic Signs Regulations and General Directions
UKRLG	UK Roads Leadership Group
USC	Unmetered Supplies Certificate
USO	Unmetered Supplier Operator
UTC	Urban Traffic Control
UTMC	Urban Traffic Management and Control
VAS	Vehicle Activated Sign
VMS	Variable Message Sign

Appendix C: TOPAS Standards

The future arrangements for TOPAS, including the ongoing provision of its standards are being developed. Authorities should therefore have regard to the current arrangements and recognised standards in force at the time of procurement, including any successor or alternative framework to TOPAS where applicable.

Term	Description	Date	Status
TOPAS 2130D	TOPAS 2130D Environmental Tests for Road Traffic Control Equipment	03/07/2023	Live
TOPAS 2500B	TOPAS 2500B Specification for Traffic Signal Controllers with corrigendum 6/12/24	06/07/2021	Live
TOPAS 2505B	TOPAS 2505B Performance Specification for Above Ground Vehicle Detector Systems for use at Traffic Signal Installations (with corrigendum 15/05/24)	28/06/2021	Live
TOPAS 2506A	TOPAS 2506A Performance Specification for Above Ground On-Crossing Pedestrian detection Systems (with corrigendum 15/05/24)	17/04/2015	Live
TOPAS 2507A	TOPAS 2507A Performance Specification for Kerbside Detection Systems for use with Nearside Signals and Demand Units (with corrigendum 15/5/24)	17/04/2015	Live
TOPAS 2508C	TOPAS 2508C Performance Specification for Tactile Equipment for use at Pedestrian Crossings	17/02/2020	Live
TOPAS 2509B	TOPAS 2509B Performance Specification for Audible Equipment for use at Pedestrian Crossings	17/02/2020	Live
TOPAS 2510B	TOPAS 2510B Performance Specification for Rising Bollards Control Systems (with corrigendum 9/12/24)	17/04/2023	Live
TOPAS 2511A	TOPAS 2511A Performance Specification for Nearside Signal and Demand Units (with corrigendum 9/12/24)	27/03/2015	Live
TOPAS 2512B	TOPAS 2512B Performance Specification for Below Ground Vehicle Detection Equipment (with corrigendum 15/5/24)	16/11/2017	Live
TOPAS 2513A	TOPAS 2513A Performance Specification for Wig Wag Signal Control Equipment (with corrigendum 9/12/24)	27/04/2015	Live
TOPAS 2514B	TOPAS 2514B Performance Specification for Light Control of Tramcars (with corrigendum 9/12/24)	02/04/2024	Live
TOPAS 2515C	TOPAS 2515C Performance Specification for Equipment to Detect High and Over-height Vehicles at low structures (with corrigendum 9/12/24)	20/05/2021	Live

Term	Description	Date	Status
TOPAS 2516D	TOPAS 2516D Performance Specification for Discontinuous Variable Message Signs (with corrigendum 5/6/24)	15/07/2021	Live
TOPAS 2517C	TOPAS 2517C Performance Specification for Electromechanical Message Signs	11/07/2022	Live
TOPAS 2522A	TOPAS 2522A Remote Monitoring and Control of Traffic Control Equipment via a Telecommunications Network (with corrigendum 9/12/24)	27/03/2015	Live
TOPAS 2523B	TOPAS 2523B Traffic Control Equipment Interfacing Specification	17/02/2020	Live
TOPAS 2540A	TOPAS 2540A Performance Specification for Portable & Temporary Traffic Signalling Systems for Temporary Traffic Management (with corrigendum 9/12/24)	30/08/2023	Live
TOPAS 2541B	TOPAS 2541B Performance Specification for Control Systems for Vehicle Activated Discontinuous Variable Messages (with corrigendum 9/12/24)	20/01/2022	Live
TOPAS 2542A	TOPAS 2542A Performance Specification for Non-contact pedestrian signal demand equipment	01/03/2021	Live
TOPAS 2543A	TOPAS 2543A Performance Specification for Signal Heads	15/02/2024	Live
TOPAS 2544A	TOPAS 2544A Performance Specification for Wait Indicator Equipment (with corrigendum 6/12/24)	20/04/2023	Live
TOPAS 2545A	TOPAS 2545A Detector Interface Protocol		Live
TOPAS 2546A	TOPAS 2546A Performance Specification for Passively Safe Products under BSEN 12767	19/07/2023	Live
TOPAS 2547A	TOPAS 2547A Performance Classification of Detectors		
TOPAS 2581A	TOPAS 2581A Performance Specification for Pedestrian Countdown Units for use at Traffic Signals	25/03/2015	Live

Appendix D: Telecommunications Procurement

The complexity of systems and the growth of IP-based communications favours the use of mobile communication. Both public and private networks are currently available. The availability and long-term viability of private (5G) networks will influence their selection by the delivery team.

LTE (Long Term Evolution) is a standard for wireless broadband communication for mobile devices and data terminals. It is technically a transitional technology between 3G and true 4G/5G — and, at the time of writing, the emerging 6G standards — and replaces both GSM (Global System for Mobile Communications) and GPRS (General Packet Radio Service).

SIM Profiles There are 3 types of profile that mobile Networks provide.

- **Mobile voice profile with data attached. The network offers only 85% availability for this profile, which is more than adequate for consumers: if the mobile does not connect, the user can wait or move to another location. This is the cheapest data available, but the least reliable method of sending and receiving data — 85% availability equates to over 14 hours a month offline;**
- **MBB (Mobile Broadband): SIMs for laptops, smart devices and Wi-Fi hubs. MBB is intended for occasional use, even where sold as 'all you can eat': data limits apply under the 'fair use policy' in the terms and conditions, and availability is also 85%. This offering appears the cheapest priced data from the networks, on the assumption that the SIM will not be connected 24/7;**
- **Pattern of use is how networks police the fair use policy, which can significantly affect the SIM's connectivity and performance. MBB SIMs are typically supplied under in-house or corporate contracts;**
- **M2M (Machine to Machine) or IoT (Internet of Things), also known as IIoT (Industrial Internet of Things): M2M SIMs are expected by the network to be connected at all times, since machines do not need to sleep. Networks offer a minimum of 95% availability for this market. M2M is the most expensive tariff but the most reliable method of sending and receiving data.**

Only a small number of MVNOs (Mobile Virtual Network Operators) specialise in delivering connectivity at 99.99% availability. The small percentage-point differences between products make a significant difference to performance over time: 95% availability means the service is down for over 7 hours a month, while 99.99% reduces this to 7 minutes a year.

Multi IMSI (International Mobile Subscriber Identity) SIM

- A Multi IMSI SIM switches SIM identities (for example, O2 to Vodafone) via Over-the-Air (OTA) commands, providing low-cost, multi-network connectivity. It offers a cheaper service by using national operator IMSIs and avoiding costly roaming charges. However, this carries the risk that SIMs can become stranded if OTA commands fail or are interrupted, leaving them unable to switch identities; a stranded device can only be recovered by a site visit;
- This is a bespoke solution, which may leave the end user uncertain about the long-term viability of the Multi IMSI approach. If an MVNO were to cease trading or change its back-office platform, leaving the SIMs dead, the end user would have no choice but to exchange the physical SIMs in their devices;
- No Network covers 100% of the UK land mass. It is always worth asking vendors of Multi IMSI systems to demonstrate how they recover a stranded SIM where there is no Bootstrap network coverage.

Roaming SIMs

Roaming SIMs fall into two categories:

- A true roaming SIM that will connect to any Network available to it;
- A steered SIM which has a list of partner Network that it will choose over any over other Network open to it. This can create a problem when the preferred partner Network is not available for the transmission of data in any given location.

eSIM (embedded SIM)

Technology is programmable and physically connected to your device's motherboard. When you want to switch carriers or activate a new plan, you can do so digitally without needing a physical SIM card swap. An eSIM will offer several advantages:

Key Features of eSIM

- **Convenience:** eSIM will allow you to switch carriers without needing to physically swap SIM cards. You can activate a new plan by scanning a QR code or entering carrier information directly on your device;
- **Dual SIM Support:** eSIM technology supports dual SIM functionality, enabling you to use multiple carriers simultaneously.

The emerging SGP32 standard, announced at Mobile World Congress (MWC) in March 2025, supports remote, bulk profile switching and removes dependency on SMS or TCP/IP protocols, supporting large-scale IoT deployments. Until this standard is widely adopted by hardware manufacturers and mobile networks, an eSIM must be regarded as a consumer product rather than a solution for electricity procurement and unmetered supplies.

Cyber Security IoT devices come with the inherent risk that they and the system that supports them along with any connected systems could be hacked. Therefore, all reasonable steps should be taken at every stage of the design, procurement* and running of any scheme.

Best practice includes requiring Cyber Essentials and Cyber Essentials Plus certification from suppliers and their supply chain before any scheme is let. As a rule of thumb, any organisation carrying, sharing or storing data should hold Cyber Essentials Plus, with all other elements in the supply chain holding Cyber Essentials.

ISO 27001 provides a framework for establishing, implementing, maintaining and continually improving an organisation's information security management system. It is not well suited to many organisations, including SMEs (small to medium-sized enterprises), and is not specifically focused on cybersecurity principles.

The UK Cyber Resilience Bill requires local authority traffic managers to strengthen cyber security of traffic systems, improve incident reporting, and ensure resilience of signals, sensors, and control networks against cyber-attacks to maintain safe, reliable road operations.

Antenna

Antennas are more important than almost any other single element in providing reliable wireless communications. The antenna and its placement can make the difference between an installation working or not.

Fig 1 shows placement of a puck antenna on top of a cabinet. The puck is designed to be mounted horizontally. This gives full 360o reception and transmission, giving the signal the best chance of being sent and received.

Placing the antenna on the side of the cabinet **Fig 2** the cabinet is shielding the antenna. The antenna is also in the wrong plane (vertical) for sending and receiving data from the mast.

Side mounting has understandably found favour as a way to prevent water ingress into the cabinet. One point to note: where silicone sealant is used as a failsafe alongside neoprene gaskets, the silicone adhesion fails over time, allowing water to pass between the silicone and the neoprene gasket and eventually ingress the cabinet.

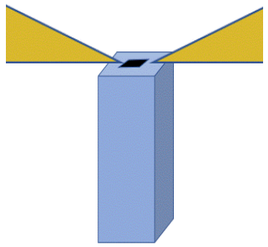


Fig 1

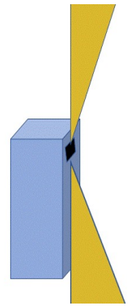


Fig 2

Keeping the cable between the antenna and the router or modem as short as possible also improves connection performance. Low-loss cabling loses around 0.5 dB per metre, so an antenna with 3 dB gain fitted to 3 metres of cable loses half its gain and performance.

VPN's

Mobile Networks do support over-the-air VPNs, and they generally do not disrupt them. Here are some key points to consider:

Functionality: VPNs work on cellular data, just like they do on Wi-Fi.

Data Usage: Using a VPN can increase your data usage by about 5-15%, depending on the encryption protocol. This is something to keep in mind if you have a limited data plan.

Performance: while VPNs can slightly reduce internet speed owing to the encryption process, this typically does not cause significant disruption. Overall performance can vary with the quality of the mobile network, and in areas with limited coverage, adding an over-the-air VPN may make the difference between a site being online or not.

Security: Mobile Networks are generally more secure than public Wi-Fi. Mobile Networks employ 256-bit encryption for enhanced security for the over-the-air element.

On balance over-the-air VPN's may be superfluous, providing there is a VPN tunnel between the Mobile providers infrastructure and the end point for the client, either a physical server and firewall or into the Cloud.

5G New Features

5G is the next generation of the LTE network, further enhancing speed and capacity. It introduces fundamental changes in how devices connect to networks, designed for more 'always on' capacity.

As with the move from 4G, most of 5G's advantages will not reach most products in the short term, since high-speed transfer of large data is not currently a requirement for most IoT applications. Over time, the 5G subsets (LTE-M, NB-IoT and URLLC) will be rolled out through further releases of the LTE programme.

NB IoT

Narrow Band-Internet of Things (NB-IoT) is a standards-based low power wide area (LPWA). Battery life of more than 10 years can be supported for a wide range of use cases.

NB IoT is designed to meet the demanding requirement of extended coverage – rural and deep indoor penetration. The level of security and the utilitarian nature of the service provided by the Network operators gives NB IoT an advantage over bespoke public frequency services, like LoRaWAN (https://lora-alliance.org) or SigFox (https://sigfox.com), that do not have national coverage in the UK.

LTE-M

LTE-M is the simplified industry term for the LTE-MTC low power wide area (LPWA) technology standard, this allows battery lifetime up to 10 years or more for a wide range of use cases. The throughput is higher than NB IoT and is seen as a direct replacement for 2G/3G applications.

As with NB IoT, it supports user identity confidentiality, entity authentication, confidentiality, data integrity, and mobile equipment identification. It offers far greater throughput and levels of Security than LoRaWAN and SigFox.

Applications:

- Remote Condition Monitoring;
- Traffic counters.

5G RedCap (5G Reduced Capability)

5G RedCap is a simplified version of 5G designed to support lower-cost and lower-complexity devices. 5G RedCap was introduced in the 3GPP Release 17 standard. Why RedCap:

Too data-heavy for LTE-M, but don't need full 5G video bandwidth

Key Features:

- **Lower Throughput** It offers reduced data rates compared to standard 5G, making it suitable for applications that don't require high bandwidth (less than 100mbs);
- **Longer Battery Life** Optimised for devices that need extended battery life, such a video streaming, sensors and alarms where mains power is not available.

Applications: Traffic signal systems (non-core control)

- UTC controller data backhaul (status, phase states, logs);
- Detector data aggregation (loops, radar, video metadata);
- MOVA performance monitoring and tuning data;
- Control logic remains local; RedCap handles rich data exchange;
- Smart detectors & sensors (high data rate);
- Radar and LiDAR traffic detectors;
- Video analytics metadata (counts, classifications, speeds – not raw video);
- Queue length and journey time analytics.

CCTV & ANPR (selective / edge-based)

- Low-to-medium resolution CCTV;
- ANPR metadata and images (not continuous HD streams);
- Event-triggered uploads (incidents, violations).

Connected roadside infrastructure

- Intelligent VMS with dynamic content updates;
- Smart pedestrian crossings (usage, compliance, faults);
- Adaptive street lighting linked to traffic conditions.

URLLC (Ultra-Reliable Low Latency Communication)

URLLC is designed to provide extremely reliable communication with minimal delay.

Key Features:

- **High Reliability** - Communication reliability up to 99.999%;
- **Low Latency - It delivers latency levels as low as 5ms, enabling real-time communication. (This speed is reliant on computing being done at the edge of the Network and not passing messages directly back to the core).**

Applications: Connected and Autonomous vehicles (CAVs). Key applications include:

- **Collision avoidance & cooperative braking:** Instant vehicle-to-vehicle (V2V) alerts for sudden braking or hazards;
- **Intersection coordination:** Real-time V2I control to manage right-of-way without traffic lights;
- **Platooning:** Tight, synchronised control between vehicles to reduce gaps safely and cut emissions;
- **Remote driving & tele-operation:** Low-latency control for emergency intervention or complex manoeuvres;
- **Sensor sharing:** Exchanging raw or fused sensor data (camera/LiDAR/radar) to "see" beyond line of sight;
- **Emergency vehicle priority:** Guaranteed, fast messages to clear routes and adapt signals.

Network Slicing

Within the 5G standard there is the ability to 'slice out' dedicated band. This will allow dedicated bandwidth to run mission critical applications.

Cost of Failure

Often overlooked, leading to choices of cheaper hardware and SIM solutions. Factoring in failure costs can change these choices.

Marketing teams may use the term 'industrial router' to improve the market perception of hardware. However, its mean time between failures often aligns with consumer-grade devices rather than true industrial specifications. The cost of repeatedly dispatching engineers to reboot or replace hardware over a project's lifespan outweighs the benefit of a cheaper product.

Summary

Achieving a system that meets specification at the best price requires informed, specialist decisions on network, software, hardware, application layer and SIM provider. Customers often rely on suppliers for technical advice, which can vary in quality; it is good practice to challenge supplier claims and ask them to substantiate these with evidence.

Procurement Act 2023:

Facilitates sourcing the best technical solutions. Procurement teams now focus on creating sustainable, long-term value rather, than just cost-cutting, making it easier to work with them to achieve the desired outcome.

LEO Satellite Communications

Low Earth Orbit (LEO) satellites orbit much closer to Earth than traditional geostationary satellites. Because the distance travelled by the signal is shorter, LEO services can offer lower latency and higher data speeds than traditional satellite communications.

LEO services use a constellation of moving satellites. The user terminal must track the satellites and transfer the connection from one satellite to another as they pass overhead.

Advantages for Intelligent Transport Systems:

Coverage: LEO can provide connectivity in rural and remote locations where fixed-line and mobile Network coverage is unavailable or unreliable.

Resilience: Satellite can provide a separate communications path when terrestrial mobile or fixed-line services fail. This can make it valuable as a secondary connection for critical roadside infrastructure and control centres.

Rapid Deployment: A satellite terminal can be deployed without waiting for fibre, leased lines or additional mobile Network infrastructure. This may be useful for temporary traffic management, roadworks, emergency response and new sites awaiting permanent communications.

Capacity: LEO broadband can support applications requiring more data than traditional satellite or low-power IoT services. Examples include CCTV, ANPR images, software updates, equipment diagnostics and the transfer of traffic data from remote locations.

Applications

- Remote traffic monitoring and data collection;
- Temporary traffic management and roadworks;
- CCTV and ANPR backhaul;
- Variable Message Signs in areas with poor mobile coverage;
- Emergency and incident response;
- Backup communications for traffic control centres.

Limitations

Clear View of the Sky: LEO terminals normally require an unobstructed view of the sky. Trees, buildings, bridges, tunnels, road cuttings and street furniture can interrupt the service. This makes the location and mounting of the terminal as important as the selection of the service.

Weather: Heavy rain, snow or ice can reduce performance, particularly where higher-frequency satellite bands are used. The terminal and its mounting must be suitable for the environmental conditions at the site.

Power and Hardware: Satellite terminals generally require more power, space and specialist mounting than a cellular router and antenna. The cost of the hardware, installation and ongoing service may therefore be higher than mobile connectivity.

Variable Performance: Available bandwidth and latency may change as satellites move, connections are handed over and capacity is shared between users. LEO should not automatically be assumed to provide the ultra-low latency or deterministic performance required for safety-critical control.

Mobility: A service designed for a fixed terminal may not support a moving vehicle. Mobile terminals, service plans and antennas should be selected specifically for use on trains, buses, maintenance vehicles or temporary traffic management equipment.

Resilience does not mean Independence

Although the signal reaches the site by satellite, the overall service still depends on the user terminal, local power, the router, satellite ground stations, the provider's core Network and the connection into the customer's system or Cloud platform.

A satellite service should not be treated as completely independent until the full communications route has been reviewed. If the mobile and satellite services use the same router, power supply, firewall, data centre or Cloud connection, a single failure may still affect both services.

Cyber Security

Satellite should be regarded as a communications bearer and not a security solution in its own right. Data should still be protected using appropriate encryption, VPNs, authentication, access controls and Network monitoring.

Procurement should also consider where traffic enters the terrestrial Network, where data is processed, the security of the satellite terminal, software update arrangements and the provider's ability to support the service throughout the expected life of the ITS equipment.

Non-Terrestrial Networks

The 3GPP standards (3rd Generation Partnership Project) are developing greater integration between terrestrial mobile Networks and Non-Terrestrial Networks (NTN). Over time, this will allow more mobile and IoT devices to connect using satellite services.

This capability is still developing. It should not be assumed that an existing 4G, 5G, LTE-M or NB-IoT device can use a satellite service without compatible hardware, firmware, antennas and a suitable Network agreement.

On Balance

LEO satellite communications can strengthen an ITS communications design, particularly for remote sites, temporary deployments and backup connectivity. It should not, however, be viewed as a universal replacement for mobile or fixed-line communications.

The strongest approach is normally a hybrid design in which terrestrial connectivity provides the primary service and satellite provides an independent secondary path. For remote sites without reliable terrestrial coverage, LEO may be suitable as the primary connection, providing the installation has a clear view of the sky and the application can tolerate variations in latency and bandwidth.

Safety-critical operation should remain local wherever possible. Loss of the satellite or terrestrial connection should not prevent a traffic signal, warning sign or other roadside system from entering or maintaining a safe operating state.

Appendix E: Roadside Technology Assets and Relevant Standards and Specifications

Purpose and application. This appendix provides an indicative, non-exhaustive reference to standards, specifications, legislation and recognised guidance relevant to the asset and contract topics covered by MRT. The maintaining authority should identify the requirements applicable to each scheme, use the edition current at the relevant procurement or contract date, apply any national or overseeing-organisation annexes, and record departures or alternative provisions through its governance process.

Asset / topic	MRT section(s)	Relevant standards, specifications and legislation	Application to MRT
Data	1.2.1; 1.3.4	UK GDPR; Data Protection Act 2018; BS EN ISO 19650-1 and -2; BS ISO 55001; ISO/IEC 27001	Data governance, information management, asset data quality, security, retention and controlled access.
Management and Operational Systems	2.3.1	BS ISO 55001; ISO/IEC 27001; NCSC Cyber Assessment Framework; UTMC technical specifications; Digital Controller Interface Specification (DCIS)	System architecture, interoperability, resilience, access control, monitoring, configuration and lifecycle management.
Fault Management Systems	2.3.2	BS ISO 55001; ISO/IEC 20000-1; ISO/IEC 27001; UTMC specifications; DCIS where applicable	Fault receipt, prioritisation, audit trail, automated interfaces, service levels, escalation, reporting and cyber security.
Asset Documentation and Retention	3.13.4; 3.13.5	BS EN ISO 19650-1 and -2; BS ISO 55001; UK GDPR; Data Protection Act 2018; Limitation Act 1980	Controlled drawings, as-built information, test records, maintenance history, retention schedules and secure disposal.
Traffic Signals and Crossing Signals	3.16	TSRGD 2016; Traffic Signs Manual Chapter 6; DMRB CD 123, CD 143 and CD 116, where applicable; BS EN 50556; BS EN 12368; BS EN 12675; current TOPAS specifications	Layout, signal displays, controllers, electrical and functional safety, detection, accessibility, commissioning and maintenance.
Interactive Signs	3.18	TSRGD 2016; Traffic Signs Manual Chapters 1, 3, 4 and 7; BS EN 12966 where the equipment functions as a variable message sign; current TOPAS specifications	Lawful sign display, optical performance, conspicuity, environmental performance, communications and fail-safe operation.
Variable Message Signs	3.19	TSRGD 2016; Traffic Signs Manual Chapters 1 and 7; BS EN 12966; DMRB control and communications technology requirements; current TOPAS specifications	Sign design, luminance, legibility, message control, structural/ electrical safety, communications and maintenance.
Fixed Enforcement / Road Safety Cameras	3.20	Road Traffic Offenders Act 1988; TSRGD 2016; current Home Office Type Approval requirements and handbooks; Data Protection Act 2018; UK GDPR; BS EN 62676 series where CCTV functions are used	Type approval, evidential integrity, calibration, siting, signage, data handling, access control and maintenance. Confirm the current approval status for each device.
Real-Time Passenger Information Systems	3.21	Public Service Vehicles (Accessible Information) Regulations 2023; BS EN 12896 (Transmodel); SIRI; TransXChange; NaPTAN; UK GDPR and Data Protection Act 2018	Accessible passenger information, data exchange, stop identification, service updates, resilience and personal-data controls.

Asset / topic	MRT section(s)	Relevant standards, specifications and legislation	Application to MRT
Car Park Management Systems	3.22	Traffic Signs Manual and TSRGD 2016 where signs are placed on-road; BS EN 12453 and BS EN 12445 for powered barriers; BS EN 62676 series for CCTV; UK GDPR	Entry/exit control, payment and occupancy systems, powered barriers, signs, communications, CCTV and data protection.
Traffic Monitoring Equipment	3.23	BS EN 12676; BS EN 50556 where integrated with traffic signal systems; DMRB control and communications technology requirements; UK GDPR where personal data is processed	Accuracy, classification, detection performance, environmental testing, calibration, communications, validation and maintenance.
Automatic Rising Bollards	3.24	BS EN 12453; BS EN 12445; BS EN ISO 13849-1; BS EN 60204-1; PAS 68 or IWA 14-1 where hostile-vehicle mitigation is required	Machinery safety, control-system safety, force testing, emergency operation, vehicle/pedestrian detection, commissioning and inspection.
CCTV Cameras	3.25	BS EN 62676 series; BS 7958; Data Protection Act 2018; UK GDPR; Surveillance Camera Code of Practice; ISO/IEC 27001	Operational requirements, image quality, siting, privacy, retention, access control, cyber security and evidential handling.
Electric Vehicle Charging Infrastructure	3.26	Public Charge Point Regulations 2023; BS 7671; BS EN IEC 61851 series; BS EN IEC 62196 series; IET Code of Practice for Electric Vehicle Charging Equipment Installation; PAS 1899	Electrical safety, connectors, earthing, inspection/testing, accessibility, payment, reliability, open data and maintenance.
Maintenance Contracts	4.1	Procurement Act 2023; Procurement Regulations 2024; NEC4 Term Service Contract, where adopted; BS ISO 55001; BS ISO 44001	Compliant procurement, defined scope, asset information, risk allocation, service levels, performance management and collaboration.
Contract Strategy	4.2	Procurement Act 2023; Procurement Regulations 2024; Cabinet Office Sourcing Playbook and Contract Management Standards; BS ISO 44001	Delivery model, market engagement, social value, whole-life cost, resilience, cyber security, mobilisation and exit planning.
Performance and Contract Management	4.3	Procurement Act 2023; Cabinet Office Contract Management Standards; BS ISO 55001; BS ISO 44001	KPIs, service levels, governance, assurance, audit, change control, escalation, continuous improvement and supplier performance.
Good Practice	4.4	UKRLG Well-managed Highway Infrastructure; BS ISO 55001; BS ISO 31000; relevant DMRB, TOPAS and manufacturer requirements	Risk-based and evidence-led maintenance, competence, lifecycle planning, auditable records and continual improvement.
Public Sector Procurement and Contract Management	4.5	Procurement Act 2023; Procurement Regulations 2024; National Procurement Policy Statement; Cabinet Office Sourcing Playbook and Contract Management Standards	Transparency, conflicts, exclusions, award criteria, notices, contract performance, record keeping and governance.
Contract Types and Delivery Models	4.6	Procurement Act 2023; NEC4 TSC/TSSC or other adopted standard forms; BS ISO 44001	Selection and tailoring of delivery model, pricing mechanism, risk ownership, collaboration, assurance and termination/exit.
Contract Documentation	4.7	Procurement Act 2023; adopted conditions of contract; BS EN ISO 19650; BS ISO 55001	Scope, asset schedules, specifications, drawings, service levels, pricing, data requirements, change control and handback.
Performance Monitoring and Contract Management	4.8	Cabinet Office Contract Management Standards; BS ISO 55001; BS ISO 44001; ISO 9001	Performance measures, reporting, audit, non-conformance, corrective action, benchmarking and improvement plans.
Asset Information and Contract Scope	4.9	BS EN ISO 19650-1 and -2; BS ISO 55001; ISO 9001	Verified asset registers, information requirements, condition data, responsibility matrices, interfaces, exclusions and handover.
Service Credits and Performance Adjustments	4.10	Procurement Act 2023; adopted conditions of contract; Cabinet Office Contract Management Standards	Proportionate and transparent remedies linked to measurable service failure, with caps, exclusions and dispute provisions.
Best Practice	4.11	UKRLG Well-managed Highway Infrastructure; BS ISO 55001; BS ISO 31000; ISO 9001	Risk-based planning, competent personnel, evidence-led decisions, assurance, lessons learned and continual improvement.
Electricity Procurement and Unmetered Supplies	4.12	Electricity Act 1989; Electricity at Work Regulations 1989; BS 7671; Elexon BSCP520; current Unmetered Supplies User Group guidance	Metering or unmetered inventory accuracy, charge codes, energy settlement, electrical safety, tariff management and audit.
Telecommunications Procurement	4.13	Electronic Communications Code; New Roads and Street Works Act 1991; BS EN 50174 series; ISO/IEC 27001; NCSC guidance	Coverage, capacity, availability, resilience, cyber security, service levels, street works, migration and exit arrangements.

Note: References should be checked against the current statutory position and publisher status before use. DMRB requirements principally apply to motorway and all-purpose trunk roads; local highway authorities may adopt them where appropriate through their own standards and governance arrangements. Product-specific TOPAS and manufacturer requirements should be identified in procurement and maintenance documentation.

Appendix F: Acknowledgements

Department for Transport

Warwickshire County Council

TRANSPORT TECHNOLOGY FORUM

TOPAS
Traffic Open Products and Specifications

artsm incorporating REMA
ASSOCIATION FOR ROAD TRAFFIC SAFETY AND MANAGEMENT

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MOBIUS NETWORKS

YUNEX TRAFFIC

Disclaimer

While every care has been taken in preparing MRT, the authors stress that it is intended for guidance purposes only. MRT aims to reflect practice in England, Scotland, Wales and Northern Ireland.

The views expressed are those of the steering group, project team and technical advisors; no legal liability is accepted for its contents, and MRT is not intended as a substitute for legal advice. The views expressed do not necessarily reflect those of the sponsoring organisations.

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